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OVER- AND UNDER-ACHIEVEMENT IN READING : DISTRIBUTION IN THE GENERAL POPULATION

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Summary. Empirical findings are presented on the distribution of over-and under-achievement in reading in five general population groups encompassing four age-groups and two parts of the country—a major city and an area of small towns. It is shown that reading achievement does not exactly parallel IQ at all levels of intelligence, confirming the inappropriateness of the achievement ratio and like statistics. It is argued that over- and under-achievement are best defined in terms of a regression equation based on IQ scores. Defined in this way, reading ability follows a generally normal distribution, over-achievement and under-achievement occurring with roughly the same frequency. However, there is a significant departure from normality at the extreme lower end of the curve such that gross under-achievement in reading occurs at well above the expected frequency. This suggests that there is a meaningful group of children with specific reading retardation which is not explicable simply in terms of the bottom of a continuum.

INTRODUCTION

More than a decade has passed since the controversy surrounding the accomplishment quotient was aired in this journal (Crane, 1959; Burt, 1959). In the interim, there has been a proliferation of research into under-achievement in reading, and much of the research has suffered from the sorts of conceptual defects discussed by Crane (1959). Arguments about under-achievement have generally started with some assumption about the distributions of under-and over-achievement in the general population. Unfortunately, different writers seem to start with different assumptions. Thus, Graham (1967) based his argument on the assumption that over- and under-achievement occur with equal frequency in the general population. Burt (1967) in his reply and in a later article (Burt, 1970) started with the assumption that children rarely achieve at a level above their mental age. Critchley (1970) has asserted that there is a hump in the distribution of reading skills which represents the presence of children with developmental dyslexia, whereas others have maintained that specific reading retardation is merely the lower end of a continuum (Department of Education and Science, 1972). The arguments, which still persist today, have been able to generate an excessive amount of unproductive heat just because there was a lack of evidence on what, in fact, are the distributions of over- and under-achievement in the general population. There have been studies of the distribution of various achievement quotients and rates, the findings of which challenged earlier assumptions (see Crane, 1959), but their results were inconclusive both because of limitations in the tests used and more particularly because of statistical defects in the use of achievement quotients. This paper sets out to give some empirical findings on the distributions of over- and under-achievement in reading in order to provide a factual base from which conceptual arguments may start. In view of possible differences in distribution according to age and sample, publication has been delayed until information was available on four age-groups and on both an area of small towns and a major city—five populations in all.

METHOD

The data all derive from studies of the total population in various age-groups, and in each case similar methods of investigation have been employed. The five samples are drawn from three separate, but related, investigations: (i) the Isle of Wight studies of children in the middle years of schooling, constituting approximately 1,100 children in each of three age groups, 9 10 and 11 years (Rutter, Tizard and Whitmore, 1970) ; (ii) the follow-up of the two youngest of these age-groups when they reached their final year of compulsory schooling, i.e., approximately 2,100 14-year-olds ; and (iii) 1,634 10-year-old non-immigrant children in an inner London borough (Berger, Yule and Rutter, in preparation).

TABLE 1

POPULATIONS AND TESTS USED.

Population	No	Test Used	
		Non-Verbal Intelligence	Reading
Isle of Wight 9-year-olds	1143	NV5	SR1
Isle of Wight 10-year-olds	1134	NV5	SR1
Isle of Wight 11-year-olds	1151	NV5	NS6
London 10-year-olds	1634	NV5	SR'A'
Isle of Wight 14-year-olds	2113	NV3	NS6

In each case all the children in the age-group of the general population studied were given group tests of non-verbal intelligence and of reading (see Table 1 for details of tests). These provided data from which to study the distribution of reading skills in the total population. However, group tests are inefficient instruments for the identification of specific skills or specific deficits. Accordingly, the group test findings were supplemented by individual study of a smaller number of children, selected in such a way as to pick out those children likely to have reading difficulties. This involved a two-stage identification procedure. In stage I of all four individually studied samples, the group test scores were used to select children for individual testing. All children scoring at or below 2 SD below the group mean on the group reading test were selected together with a randomly selected sample of the total population. In addition a number of other selection sources were used in order to pick up children at risk who might have missed this main single screening procedure. These varied somewhat with sample. Thus, in the Isle of Wight studies discrepancies between the scores on the group IQ and group reading test were also used and in the London study a sample of children whose reading on the group reading test was just above 2 SD below the mean were included. All children selected for individual testing were given the short form of the WISC (Wechsler, 1949) and Neale's Analysis of Reading Ability (Neale, 1958).

RESULTS

(*a*) *Regression Effect.*

The first issue concerns what measure is to be used to assess over- and under-achievement. In this context, over- and under-achievement are used to refer to achievement in reading which is much superior or inferior to that expected for children of the same age and general level of intelligence ; that is specific educational skills and specific educational deficits. That immediately raises the question as to what level of reading should be expected (on the basis of statistical probabilities) for children of any level of age and intelligence. The achievement ratio was devised by Franzen (1920) half a century ago for just this purpose and in one form or another its use persists today. The reading achievement ratio equals the reading age divided by the mental age multiplied by 100. The idea, as expressed by Burt (1950, p. 34) was " if a child's achievement ratio is exactly one hundred, then teaching is keeping pace with mental growth ; the child, it may be inferred, is learning his lessons up to the full limit of his born capacity." Similar notions underlie Monroe's ' reading index ' (1932) and Myklebust's ' learning quotient ' (1968). There are conceptual problems with respect to these notions (Crane, 1959 ; Graham, 1967 ; Rutter and Yule, 1973a) but, more serious in practice, there are also statistical objections. The most important of these stems from the ' regression effect.' Wherever the correlation between measures (such as mental age and reading age) is less than perfect, the children who are well *above* average on one measure will be less superior on the other and those who are well *below* average on the first measure will be less inferior on the second (Thorndike, 1963). In other words, the mean reading age of 10-year-olds with an average mental age of 13 years will *not* be 13 years, it will be more like 12 years. Only in the middle of the distribution will the two be the same (Pilliner and Reid, 1972 ; Rutter and Yule, 1973a).

TABLE 2

REGRESSION EFFECT.

		IQ Bands			
		−2 SD	−2 SD to −1 SD	−1 SD to +1 SD	+1 SD to +2 SD
Isle of Wight 9-year-olds	N	36	170	760	173
	IQ	−2·371	−1·353	+0·101	+1·374
	Reading	−1·793	−0·899	+0·099	+0·778
Isle of Wight 10-year-olds	N	59	133	780	163
	IQ	−2·494	−1·341	+0·169	+1·232
	Reading	−1·911	−0·767	+0·155	+0·572
Isle of Wight 11-year-olds	N	57	125	856	113
	IQ	−2·654	−1·406	+0·234	+1·223
	Reading	−1·546	−0·894	+0·130	+0·820
London 10-year-olds	N	28	248	1060	286
	IQ	−2·232	−1·388	+0·023	+1·402
	Reading	−1·081	−0·839	+0·035	+0·825
Isle of Wight 14-year-olds	N	85	250	1439	339
	IQ	−2·531	−1·451	+0·125	+1·219
	Reading	−1·704	−0·956	+0·103	+0·731

N.B.—All mean scores in the table are given as standard scores.

While this follows inexorably from the statistical properties associated with correlation coefficients less than unity, many educationalists have doubted the size or the reality of the effect in actual practice. In order to examine what relationship is actually found between reading and intelligence in the general population, the group test findings were examined for each of the five total child populations studied. For this purpose the populations were split into four groups : those with an IQ at least 2 SD below the mean, those with an IQ more than 1 SD but less than 2 SD below the mean, those with an IQ in the range minus 1 SD to plus 1 SD above the mean, and those with an IQ more than 1 SD but less than 2 SD above the mean.* For each of these groups the mean IQ and mean reading score was calculated. Table 2 gives the findings, all mean scores being quoted as standard scores in order to facilitate comparisons between IQ and reading.

It may readily be seen that the expected regression effect is indeed found in practice. In the middle of the distribution the mean IQ and mean reading score are aproximately equal, being near zero in each case. However, when a group who are superior in intelligence is selected they are found to be less superior in reading. Thus, in the London 10-year-olds the top IQ group have a mean IQ of +1·402 SD but a mean reading score of only +0·825 SD. Similarly, the comparable below average IQ group in the same sample has a mean IQ of −1·388 SD but a better reading score of −0·839 SD. In short, the regression effect is clearly demonstrated. Except at the precise middle of the distribution, a child's mental age and reading age (or IQ and RQ) should *not* be expected to be the same. As a consequence, the achievement ratio is a misleading statistic which will over-estimate the number of ' under-achievers ' in children of high IQ and under-estimate the same in children of low IQ.

(*b*) *Regression Equation.*

The only satisfactory means of taking into account this regression effect when assessing over- and under-achievement is that provided by the regression equation. The rationale of this approach has been clearly presented by Thorndike (1963) and the arguments will not be repeated here. Suffice it to state that, knowing the correlation between the predictor variable (mental age or IQ) and the criterion variable (reading age or reading score), it is possible to calculate the expected value of reading attainment for any particular level of the predictor variable. Thus, one can determine whether the child scores above, at, or below this predicted value. More importantly, it is possible to determine the statistical probability of any deviation from the expected value, so reducing the arbitrariness of the decision of where to place the cut-off point in deciding what level of retardation is necessary before considering a child as having a reading difficulty.

In using regression techniques, certain statistical assumptions must be met (Cronbach, 1971). The criterion variable should be normally distributed for all levels of the predictor variable and at each level the variance should be equal (homoscedastic). The regression line should be linear throughout the range within which it will be used. The extent to which a particular regression equation can be generalised to different groups will depend greatly on the stability of the correlation between predictor and criterion. This will be influenced by sampling and other influences (e.g., restriction of range). Cross-validation is essential if a single regression equation is to be used for different groups. Also, the use of regression techniques with the individual case presupposes that the individual could have been selected for the sample upon which the regression function is based.

Angoff (1971) recommends the use of expectancy tables as another effective way of selecting over- and under-achievers. This approach might be appropriate for situations where the assumptions underlying regression techniques cannot be met.

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[*] The group with an IQ at least 2 SD above the mean was omitted in view of limitations due to ceiling effects on the reading test—see below.

Although the technique of regression analysis has long been available, it has been applied only rarely, and then mainly by British investigators (e.g., Ravenette, 1961 ; Fransella and Gerver, 1965 ; Yule, 1967 ; Levy and Tucker, 1972). Reference should be made to these papers for a fuller account of the procedure.

(*c*) *Distributions of Over- and Under-achievement as Assessed on Group Tests.*

For each of the five populations, correlations between IQ and reading were computed. Regression equations (see Table 3) were determined and the differences between actual and predicted reading ages plotted (Table 4).

TABLE 3

REGRESSION EQUATION TO PREDICT GROUP READING SCORE FROM NON-VERBAL IQ

Population	Correlation Non-Verbal IQ and Reading	Regression Equation
Isle of Wight 9-year-olds	0·622	$R=7{\cdot}38+(0{\cdot}28\times IQ)$
Isle of Wight 10-year-olds	0·614	$R=9{\cdot}11+(0{\cdot}26\times IQ)$
Isle of Wight 11-year-olds	0·607	$R=1{\cdot}34+(0{\cdot}42\times IQ)$
London 10-year-olds	0·607	$R=7{\cdot}84+(0{\cdot}31\times IQ)$
Isle of Wight 14-year-olds	0·639	$R=15{\cdot}59+(0{\cdot}43\times IQ)$

TABLE 4

DISTRIBUTION OF OBSERVED AND PREDICTED READING IN GROUP TESTS.

Populations	Reading (in terms of standard errors of prediction from mean)					
	Less than 2 SE	–2 to –1 SE	–1 to +1 SE	+1 to +2 SE	More than 2 SE	Total
Isle of Wight 9-year-olds	Obs 50‡ Pred. 26	140 155	779 780	155 155	19 26	1143
Isle of Wight 10-year-olds	Obs 61‡ Pred. 26	104 154	859 774	106 154	4‡ 26	1134
Isle of Wight 11-year-olds	Obs. 27 Pred. 26	130 156	841 786	137 156	16* 26	1151
London 10-year-olds	Obs 45 Pred. 37	230 222	1112 1115	226 222	21† 37	1634
Isle of Wight 14-year-olds	Obs. 77‡ Pred 48	208 287	1581 1442	224 287	23‡ 48	2113
Total Group	Obs 260‡ Pred. 163	812 975	5172 4899	848 975	83‡ 163	7175
Expected %	2·28%	13·59%	68·26%	13·59%	2·28%	

* Difference from predicted significant at 5% level or better.
† Difference from predicted significant at 1% level or better.
‡ Difference from predicted significant at 0·1% level or better

In making these calculations, all children whose IQs fell below 70 were excluded. It is known that mental retardation (which itself constitutes a 'hump' at the bottom end of the distribution of intelligence) is usually associated with very poor reading skills, so that the inclusion of mentally retarded youngsters might have led to an artefactual increase in the number of under-achievers. However, the number of children with an IQ below 70 is necessarily small and their inclusion or exclusion was found to make very little difference in practice.

All the regression equations in Table 3 satisfy the linearity criterion, and similar variances in reading were found for different levels of raw score on the IQ test (apart from some reduction at the top of the IQ range due to range restriction at the ceiling of the reading tests). There was also homoscedacity when IQ variances were calculated for different levels of raw score on the reading test. The correlations between IQ and reading were closely comparable in all five samples, indicating the stability of the predictions.

It may be seen that, overall, the proportion of under-achievers in the general population was roughly equal to the proportion of over-achievers. Over- and under-achievement followed a normal distribution except for the extremes of the ranges. Thus, under-achievers were more common than expected on the basis of a normal distribution. This was so in all five samples, the differences being significantly different in three of them and also in the total pooled population. Whereas the expected normal distribution is 2·28 per cent of individuals with reading more than 2 standard errors of prediction below the mean, in fact the figures in the five populations were 4·37 per cent, 5·37 per cent, 2·34 per cent 2·75 per cent and 3·64 per cent. These distributions are shown in the form of histograms in Figure 1.

In both the samples where the excess of under-achievers fell short of significance it is known that the observed number of under-achievers is an under-estimate. Because of the distribution of scores in the London 10-year-olds, children with an IQ of 83 or less could not obtain a reading score more than 2 standard errors of prediction below the mean (see Table 5). Similarly, for the Isle of Wight 11-year-olds this applied to children of IQ 77 or less. In the Isle of Wight 9-year-olds the cut-off came at 74, only just above the floor of the IQ test, and the effect did not apply to either of the other two populations. It may safely be concluded that the number of children whose reading on group tests is *greatly* below that expected for children of their age and intelligence is considerably above that which follows from a normal distribution.

However, it may also be seen from Table 4 that there is a deficit of children whose reading is greatly above prediction. This is probably an artefact stemming from the ceiling on the group test of reading employed. In all five samples a proportion of children could not achieve a reading score 2 standard errors of prediction above the mean simply because the reading test did not go up that far.* The effect is most marked in the Isle of Wight 10-year-olds and 14-year-olds where over half the children would be excluded in this way, children of IQ 89 or over and IQ 92 or over, respectively, being unable to be included (Table 5). As these are the two populations where the observed proportion of over-achievers falls most below prediction it seems very likely that the deficiency of over-achievers is simply an artefact of the ceiling on the reading tests used.

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* This is because we chose group tests which could most effectively identify the poorest readers for individual testing.

FIGURE 1

DISTRIBUTIONS OF DIFFERENCES BETWEEN OBTAINED AND PREDICTED SCORES ON THE GROUP READING TESTS

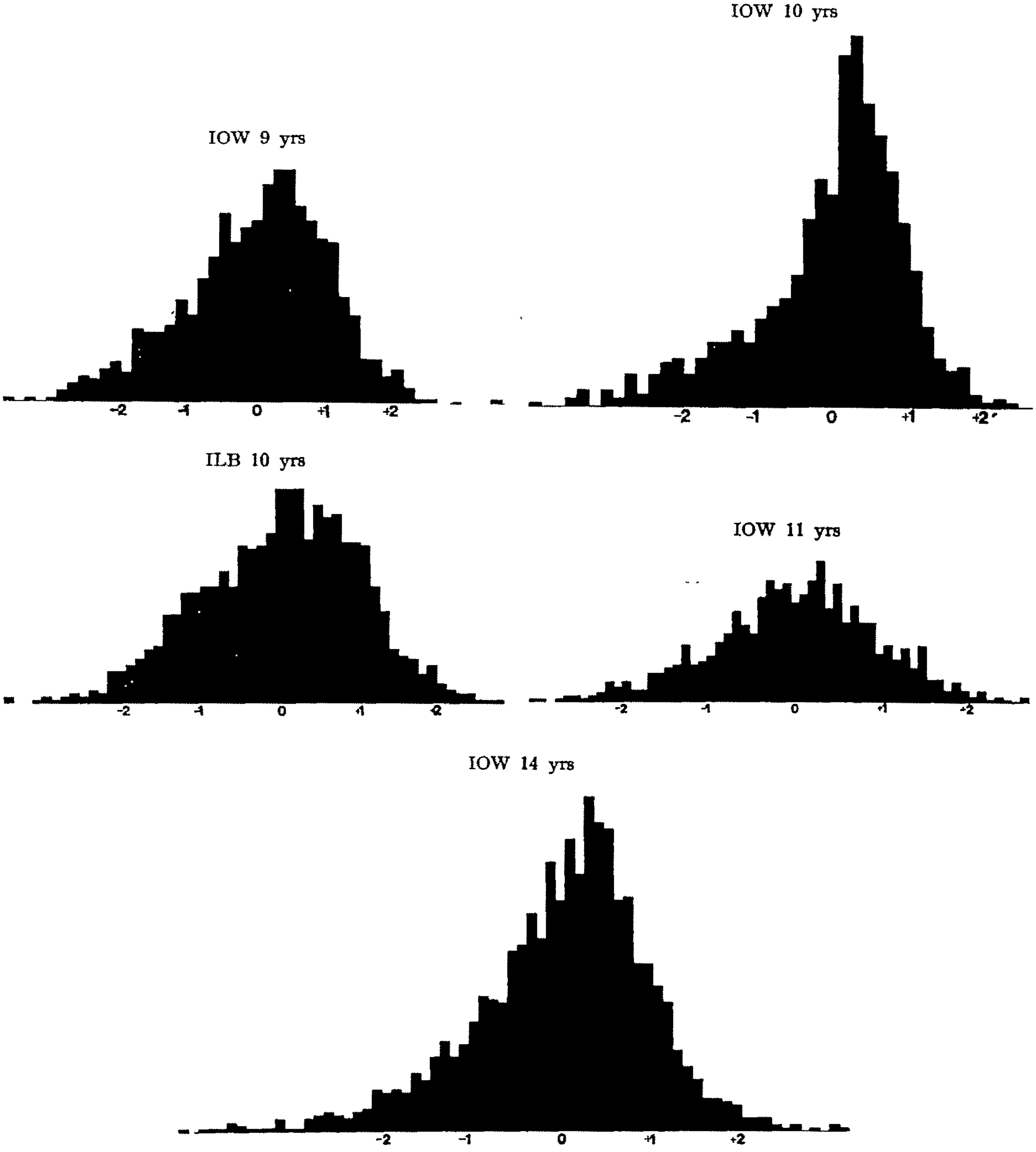

TABLE 5

FLOOR AND CEILING EFFECTS.

Populations	IQ level below which reading cannot be 2 SE below prediction	IQ level above which reading cannot be 2 SE above prediction
Isle of Wight 9-year-olds..........	74	100
Isle of Wight 10-year-olds..........	—	89
Isle of Wight 11-year-olds.........	77	114
London 10-year-olds...	83	115
Isle of Wight 14-year-olds.........	—	92

N.B.—IQ scores given in terms of a test with a mean of 100 and SD of 15.

(*d*) *Prevalence of Under-Achievement as Assessed on Individual Testing.*

Group tests are necessarily crude instruments. In particular it is difficult to devise a group test of intelligence which requires no reading skills. As a result, group tests are an unsatisfactory means of picking out children whose reading achievement is poor in spite of good intelligence. Individual tests are much better for this purpose and it was for this reason that in four out of the five populations individual tests were used to diagnose children with specific reading retardation, i.e., under-achievement on individual tests (the Isle of Wight 11-year-olds were not studied in this way because of restriction of resources). In each case, children were selected for individual testing on the basis of multiple group screening procedures. Accordingly, children with specific reading retardation are those who are selected on group tests *and* who meet the criteria set on individual tests. Unless the group tests are perfect screening procedures (and we have evidence that they are not) the prevalence figure for under-achievement will be misleadingly low, and this should be taken into account in interpreting the findings.

As with the group tests, the data were examined to determine if they met the requirements of regression techniques. With the exception of the 9-year-olds, the regressions were linear within the range used and the variances were homoscedastic. However, in the 9-year-old group, the correlation between IQ and reading was exceptionally low (0·36), there was significant heterogeneity within the group in that the correlations differed by sex and the variance was heteroscedastic. Their IQ level was also slightly above that in the general population. It appeared that, by chance, one randomly selected control group had turned out to be non-representative Inevitably, this will occur occasionally with randomly chosen groups, but it meant that the group had to be omitted.

TABLE 6

REGRESSION EQUATIONS TO PREDICT NEALE READING SCORES FROM WISC IQ.

Sample	Test	Correlation Neale and WISC	Regression Equation	Standard Error of Prediction
Isle of Wight ..	Reading Acc. ..	0·55	$75{\cdot}33+(1{\cdot}11\times IQ)$	15·16 mo
10-year-olds .	Reading Compr.	0·57	$77{\cdot}06+(1{\cdot}16\times IQ)$	14·97 mo.
Isle of Wight	Reading Acc. .	0·45	$100{\cdot}92+(0{\cdot}91\times IQ)$	14·17 mo.
14-year-olds .	Reading Compr.	0·50	$104{\cdot}03+(0{\cdot}87\times IQ)$	11·86 mo.

(Equation for Isle of Wight 10-year-olds also used for London 10-year-olds)
"IQ" = Sum of four scale scores on Short WISC.

For each age group, apart from the 9-year-olds, the randomly selected control group was used to calculate a regression equation predicting reading on the Neale Analysis of Reading Ability from the child's short WISC score (Table 6). As a separate equation was produced for each age-group a multiple regression equation including age was not necessary, as it had been in the earlier Isle of Wight studies (Rutter, Tizard and Whitmore, 1970). The correlation between IQ and reading, and the mean IQ, was similar in the London 10-year-olds and the Isle of Wight 10-year-olds so the same regression equation was used for both (Berger, Yule and Rutter, in preparation). In order to make proper comparisons between groups it is essential to use exactly the same group screening procedures. This would necessitate using only the group reading test in each case as this was the only common element. This procedure was followed, as was necessary, in comparing the prevalence in London and Isle of Wight children (Berger, Yule and Rutter, in preparation). However, here, where the purpose is to compare each observed prevalence figure with that expected on the basis of a normal distribution, it is preferable to include *all* group screening procedures in order to arrive at the best possible estimate of total prevalence. The findings are given in Table 7. In each case specific reading retardation is defined in terms of a score on the Neale Analysis of Reading Ability which is at least 2 standard errors of prediction below the mean (in line with Angoff's recommendation to use extreme discrepancies). As the Neale test provides separate measures of reading accuracy and reading comprehension, estimates are provided for each. For 10-year-olds this amounts to a reading accuracy score 31 months below prediction and for 14-year-olds it is 29 months below prediction.

TABLE 7

OBSERVED AND EXPECTED RATES OF SPECIFIC READING RETARDATION.

	Children with Specific Reading Retardation.			
	Reading Accuracy		Reading Comprehension	
	Observed %	Predicted %	Observed %	Predicted %
Isle of Wight 10-year-olds (N=1134)	3·09	2·28	3·61†	2·28
London 10-year-olds (N=1634)	6·32‡	2·28	9·26‡	2·28
Isle of Wight 14-year-olds (N=2113)	4·35‡	2·28	4·40‡	2·28

† $P<0{\cdot}01$.
‡ $P<0{\cdot}001$.

On this definition, if reading retardation were normally distributed there should be exactly 2·28 per cent of children with specific reading retardation of the severity specified. In fact, the actual number or children was appreciably greater than that in all cases. In the Isle of Wight 10-year-olds the figure was 3–3½ per cent, in London 10-year-olds it was 6–9 per cent and in the Isle of Wight 14-year-olds it was 4 per cent. In all three instances, despite incomplete screening procedures, the prevalence of specific reading retardation was well in excess of the expected 2·28 per cent. The individual test findings confirm those based on group tests. Severe degrees of under-achievement in reading occur much more commonly than would be expected on the basis of a normal distribution.

CONCLUSION

The controversy raised by Crane now seems nearer resolution. In his elegant monograph, Thorndike (1963) argued convincingly on statistical grounds that the only satisfactory way to define under-achievement is through the use of regression techniques. The present empirical findings show the size of the error which follows from the false assumption that reading attainment should exactly parallel intelligence, and also demonstrate the reality of the regression effect. It may be concluded that the achievement ratio is a discredited statistic which should be abandoned. A regression equation remains the only really satisfactory means of defining under-achievement. This poses the problem of what population to choose in deriving the equation. For the purposes of this paper it was appropriate to use each population as its own base, but in ordinary circumstances such data will not be available and another solution must be found. This issue is beyond the scope of the present paper, but it is considered more fully elsewhere (Berger, Yule and Rutter, in preparation).

The argument, given weight by the authority of Burt, that over-achievement is a rare phenomenon can finally be laid to rest. Four replications in different populations and different age-groups have amply confirmed the finding that, in general, over-achievement is just as frequent as under-achievement. This would seem to follow from the known correlation between IQ and reading, but now it has been found to occur in practice as well as in theory. The most important educational implication of this finding is that as many normal children will 'under-achieve' to some extent just as many will 'over-achieve.' In itself this is not a matter of pathology but simply a consequence of the normal variation between individuals. To some extent this variation (both above and below the mean) will be a function of genetic heterogeneity, but also it will be influenced by a range of environmental influences in the family, in the school and in the community. Whether serious attention ought to be paid to the finding that a child is 'under-achieving' should depend, amongst other things, on the degree of his 'under-achievement.' Fortunately, the same regression technique which allows calculation of the extent of under-achievement also provides a means of calculating the frequency with which any degree of under-achievement will occur in the general population.

However, while the discrepancy between observed and predicted reading follows a generally normal distribution, with over-achievement roughly balancing under-achievement, there is a departure from normality at the extreme lower end of the curve. *Extreme* under-achievement in reading occurs at appreciably above the rate expected on the basis of a normal distribution and so constitutes a hump at the lower end of the Gaussian curve. Such humps can occur when the sample tested is broader than that upon which the test has been standardised (Gruenberg, 1966) but that cannot be the explanation of this hump as the test was standardised on precisely the same population as that which showed the hump. There are no grounds for believing that the hump is anything but a true finding, and the finding implies that there is a group of children with severe and specific reading retardation which is *not* just the lower end of a normal continuum.

The result suggests that there may be some validity to the distinction first drawn long ago (Schonell, 1935) between specific reading retardation and general reading backwardness. Even so, there is no practical utility in the distinction unless the two groups are also distinguishable on other criteria not directly part of reading (Davis and Cashdan, 1963). This issue has been examined elsewhere with the conclusion that there are in fact many differences between the two groups in terms of prognosis, attainments in spelling and arithmetic, sex ratio, frequency of overt neurological disorder, and type of developmental delay (Rutter and Yule, 1973a and 1973b ; Yule, 1973).

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SOCIAL DIFFICULTY IN A STUDENT SAMPLE

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Summary. Recent research shows a high prevalence of psycho-social disturbance in university students, and there is some evidence that inadequate social participation is associated with disturbance and with failure to complete courses. This study examines the extent, degree and type of difficulty in social situations reported by a random sample of Oxford University students. Nearly 10 per cent, mostly from lower social classes and small families, had great difficulty in, or tried to avoid, about six common social situations described in a questionnaire, and a principal components analysis discriminated different types of social difficulty.

INTRODUCTION

Recent studies indicate that, while there is little evidence to suggest that students are more at risk to serious psychiatric disturbance than other members of the population (Payne, 1969; Davidson and Hutt, 1964), there does seem to be a high prevalence of less serious problems which have been called ' psycho-social ' (Lucas and Linken, 1970; Kidd and Caldbeck-Meenan, 1966; Kessel and Shepherd, 1962). Attempts to identify the precipitating social factors in psycho-social disturbance and academic failure or drop-out have suggested that they were often associated with, amongst other things, few or unsuccessful attempts at social participation (Lucas, Kelvin and Ojha, 1966; Hopkins, Malleson and Sarnoff, 1958; Kidd, 1965; Summerskill, 1962).

The focus of interest in the present study was the extent and degree of difficulty reported by a random sample of students in social situations, and the sorts of situations which present most difficulty to them. This study forms part of a research programme concerned with the problem of social inadequacy and its treatment by social skills training (Argyle, Trower and Bryant, in press).

METHOD

The Sample.

A 1 in 10 random sample of second year members of Oxford University, admitted in 1969, was drawn from the 1971 university register, and this procedure yielded the names of 312 individuals, 252 men and 60 women, to whom questionnaires were sent. Of these, 223 (71 per cent) returned completed questionnaires, 69 per cent of the men and 82 per cent of the women. No reply was received from 77 (25 per cent), 26 per cent of the men and 18 per cent of the women, even after two further attempts to contact them. Of the remaining men, five refused to participate, one had died and six were no longer members of the university.

Table 1 shows the distribution, on various social attributes, of the sample of respondents and the total population from which the sample was drawn. This confirms that the sample represents the universe within the limits of chance sampling error, in terms of age, marital status, nationality, student status and faculty.

The vast majority of the students were, as would be expected, single, under 21, British undergraduates. Three-quarters came from middle class homes, and 57 per cent had been educated in independent and direct grant schools. 13 per cent were only children.

TABLE 1

Distribution of Men and Women in the Student Sample on Various Social Attributes and Comparison with the Total Population

		Sample			
		Men (N=174) %	Women (N=49) %	Total (N=223) %	Total* Population (N=2,761) %
Age	Under 21	84	83	84	81
	21+	16	16	16	19
Marital State	Single	94	96	94	94
	Married	6	4	6	6
Nationality	British	91	92	91	87
	Other	9	8	9	13
Student Status	Undergraduate	86	90	87	87
	Graduate	14	10	13	13
Faculty	Sciences	40	38	39	36
	Social Sciences	30	6	24	24
	Arts	30	56	36	40
No. of Children in family (including subject)	One	13	14	13	Not available
	Two	38	45	39	
	Three	27	24	26	
	Four+	21	16	20	
Social Class (Father's occupation)	I	26	37	29	Not available
	II	44	45	45	
	III	23	12	21	
	IV	2	2	2	
	V	4	2	3	
	Forces	0	1	1	
Composition of last school	Single Sex	88	88	88	Not available
	Co-educational	12	12	12	
					1965/66 Admissions †
Last School Attended	Independent	38	31	37 (37)	40
	Direct Grant	18	25	20 (21)	18
	Maintained	38	35	36 (40)	41
	Other	6	8	6 (2)	1

* Source: University Registry Statistical Unit.

† Source: Franks Commission, University of Oxford (1966). This data was for undergraduates only. The comparable figures for undergraduates in the sample are given in parentheses.

No significant differences were found between the sample and the total population. Test of significance · χ^2 for finite universe compared with sample of universe (McNemar, 1949).

The Questionnaire.

The questionnaire, administered by post in May, 1971, asked about the degree of difficulty felt in 30 specified situations which were selected on the basis of difficulties raised by a study of psychiatric patients. They ranged from encounters of the ' rubbing shoulders ' variety, such as walking down the street or using public transport, to more intimate situations such as getting to know someone in depth. Respondents were asked, for each situation, to rate themselves on a five point scale : 0—no difficulty, 1—slight difficulty, 2—moderate difficulty, 3—great difficulty, and 4—avoidance if possible. In the instructions difficulty was defined as follows : " The situation makes you feel anxious or uncomfortable, either because you don't know what to do or because it makes you feel frightened, embarrassed or self-conscious." The ratings covered two time periods, the present time and the equivalent time a year ago.

RESULTS

In the analysis each individual was given a score of difficulty by ascribing a numerical value to the ratings, so that rating 0 contributed zero to the score, and rating 4 contributed 4 ; the scores across all 30 situations were then summed. The mean scores for the present time and a year ago, and for men and women, are shown in Table 2. The scores for the present time were significantly lower than for a year ago. This difference recurred throughout the analysis, and is discussed later.

TABLE 2

MEAN SCORES OF DIFFICULTY FOR ALL RESPONDENTS AND FOR MEN AND WOMEN SEPARATELY.

	Present time			A year ago			
	Mean	Range	S.D.	Mean	Range	S.D.	Sig. level*
Total . . .	17·48	0–48	11·69	24·21	0–66	13·96	·001
Men	16·97	0–48	11·48	23·59	0–59	13·41	·001
Women . .	19·31	0–44	12·23	26·44	0–66	15·56	·001

* Significance levels were calculated by means of the Wilcoxon matched pairs, signed-ranks test.

Almost everyone (99 per cent) rated themselves as having difficulty, although in many instances this was only slight. However it is probable that some degree of anxiety in social situations is normal and for this reason the ratings of slight difficulty were combined with the ' no difficulty ' ratings for most of the analysis. Ratings of moderate difficulty or worse were made by three-quarters of the respondents in, on average, five to six situations at the present time. Ratings of great difficulty or avoidance were made by 40 per cent in an average of two to three situations. 21 students reported great difficulty or avoidance in as many as six or more situations in their first year and 19 did so in four or more situations in their second year ; it is possible that these students, about 9 per cent of the sample, were suffering from quite serious social problems.

Individual Situations.

(*a*) *Overall difficulty*. The 30 situations on the questionnaire are shown in Table 3, rank ordered according to the percentage of respondents who rated moderate difficulty or worse in them.

TABLE 3

PERCENTAGE OF RESPONDENTS SCORING MODERATE DIFFICULTY OR WORSE (2, 3 or 4) IN EACH SITUATION.
(N=223)

	Situation*	Present Time	Year Ago	P
21	Approaching others	36	51	·001
14	Going to dances/discotheques	35	45	·01
25	Taking initiative in conversation	26	44	·001
5	Going to parties	25	42	·001
19	People you don't know well	22	37	·001
8	Going out/opposite sex	21	38	·001
11	Being in a group/opposite sex	21	35	·001
24	Getting to know someone in depth	21	29	·001
29	Talking about self and feelings	19	26	·001
26	Looking at people in the eyes	18	26	·001
22	Making decisions affecting others	17	31	·001
17	Going into a room full of people	17	30	·001
30	People looking at you	16	26	·001
18	Meeting strangers	13	28	·001
16	Being with younger people	13	19	·01
7	Making friends of own age	11	20	·001
27	Disagreeing/putting forward views	9	23	·001
4	Going into pubs	9	17	·001
9	Being in a group/same sex	9	15	·01
28	People standing/sitting very close	9	14	·001
10	Being in a group/men and women	8	18	·001
6	Mixing with people at work	8	16	·001
12	Entertaining in your own home	7	19	·001
15	Being with older people	5	8	
23	Being with just one other person	4	9	·01
13	Going into restaurants/cafes	3	10	·001
2	Going into shops	1	5	·05
1	Walking down the street	1	4	
3	Using public transport	1	3	
20	Being with friends	1	1	

Test of significance: χ^2, using McNemar's formula for correlated data Yates's correction for continuity used where appropriate.

* Some situations quoted in abbreviated form.

The situations should not be considered as representing equal forms of stress, since some are clearly less taxing than others, for instance, walking down the street compared with getting to know someone in depth. The order of difficulty found was in this sense much what one would expect. Little difficulty was reported in situations requiring relatively superficial contact or where close bonds had already been established, such as being with close friends. More difficulty was reported in situations demanding a more complex level of interaction, often with people of the opposite sex, and where close bonds had not been established. The latter could be described as posing a greater personal risk in terms of acceptance or rejection.

Although the order was not unexpected, the proportions of students reporting difficulty was surprisingly high in some cases. For example, half of them reported moderate or worse difficulty in approaching others and making the first move in starting up a friendship in their first year, something which could be considered essential to their social well-being at university. Although this improved, a third were still reporting difficulty in doing this a year later.

At the other end of the scale there was a small cluster of students who reported difficulty in such apparently 'easy' situations as going into shops and restaurants, walking down the street and using public transport. This is typical of the pattern of difficulties reported by individuals suffering from social phobias, a psychiatric problem which has recently come under increasing investigation. Although numerically small in the student sample, it is a matter of concern that between 3 and 10 per cent reported such difficulties in their first year.

(*b*) *Differences between the present time and a year ago.* Table 3 also shows the proportions of people reporting difficulty now compared with a year ago. In all but four situations there was a significant change from difficulty a year ago to little or no difficulty now, and this trend held for all except one situation for both men and women.

This decrease in the amount of difficulty reported by students in their second year at the university may merely reflect a tendency to magnify problems in retrospect, or people's desire to believe or to report that they have increased in maturity and sophistication. On the other hand, it seems reasonable on common sense grounds to assume that moving into a totally new environment, particularly when in most instances this coincided with leaving school, is likely to be a stressful experience, and we would suggest that the greater difficulty reported in the first year does represent a genuine difference.

If this is so, it suggests that many difficulties in social situations resolve themselves with time and experience. This would appear to be supported by the fact that the proportions of ratings of 'avoidance of the situation' had not decreased by the second year, suggesting that without experience improvement is unlikely.

(*c*) *Differences between men and women.* There were some significant differences between the men and women in the situations they found difficult, and these are shown in Table 4.

TABLE 4

Differences Between Men and Women in the Percentage Who Scored Moderate Difficulty or Worse in Various Situations.

Q. no	Situation	Present time				A year ago			
		Men %	Wmn. %	χ^2	P	Men %	Wmn. %	χ^2	P
14	Going to dances, discos	31	46	4·2	·05				
5	Going to parties . . .	22	35	3·6		39	53	3·1	
8	Going out/opposite sex	24	12	3·0					
19	People don't know well	20	33	4·2	·05				
11	Group/opposite sex . .	26	4	11·0	·001	39	21	5·7	·05
22	Decisions affecting others	15	24	3·6					
17	Room full of people . .	13	29	6·5	·05	27	42	4·1	·05
30	People looking at you	14	24	2·8					
27	Disagreeing	5	25	15·1	·001	18	40	10·5	·01
4	Going into pubs	4	28	24·0	·001	11	37	18·8	·001
6	Mixing at work	6	16	4·4	·05				

Apart from going into pubs, a traditionally male preserve, these differences do not seem to follow a pattern. For example, they would not seem particularly to support the finding of Argyle and Williams (1969) that adolescent females felt observed while males felt themselves observers during cross-sex social contacts. Nor, with the exception of disagreeing with others, would they seem to support the suggestion that women are expected to be dependent and accommodating towards the opposite sex (e.g., Danziger, 1971), in which case one would have expected them to report more difficulty in situations requiring assertive behaviour, for example, situations 21, 22 and 25.

One factor which should be taken into account in considering the differences between men and women is the overall preponderance of men at Oxford University, something in the order of four men to one woman. This may well create problems and anxieties for the men in cross-sexual encounters which would not arise in other groups.

Principal Components Analysis.

A principal components analysis on the data from the present time was carried out in order to find out (*a*) if any items were correlated, and whether there were any general components of social difficulty, and (*b*) if any persons correlated on these general components could also be correlated on their personal characteristics. The calculations were made on the scores of all 223 respondents on all 30 situations, using the procedure described by Slater (1967). The analysis was applied to the variances and covariances of the scores of each student without normalisation, so differences in their variation were retained. This involved treating the differences as meaningful, in the hope that this would increase the questionnaire's sensitivity to variations in difficulty. The vectors show the correlation of the item with the component.

(*a*) *The components*: *Component* 1. The first component accounted for 25·5 per cent of the variance. Its positive pole refers to situations which involve actively seeking contact with relative strangers, particularly of the opposite sex.

Item	*Vector*	*Content*
14	·50	Going to dances.
21	·37	Approaching others.
5	·26	Going to parties.
25	·22	Taking the initiative in conversation.
19	·18	Being with people you don't know well.
8	·17	Going out with someone of opposite sex.

The contrasting pole refers to a more heterogeneous group of situations which are less socially involving or which involve less exposure to strangers:

23	—·17	Being with one other person.
13	—·17	Going into restaurants or cafes.
2	—·25	Going into shops.
20	—·26	Being with close friends.
3	—·27	Going on public transport.
1	—·28	Walking down the street.

It will be recalled that these situations are almost exactly those ranked at the extreme top and bottom of Table 3. It is clear, therefore, that the first component is also closely related to 'social difficulty,' and that there is a fairly general component of social difficulty roughly describable as actively seeking out relative strangers, particularly of the opposite sex.

Component 2. The second component accounts for 9·9 per cent of the variance. It selects from the situations found at the positive pole of the first component the ones which involve public social contact:

Item	*Vector*	*Content*
14	·56	Going to dances, discos.
5	·33	Going to parties.
4	·26	Going to pubs.
16	·14	Being with younger people.

This is in contrast to situations demanding more intimate contact:

26	—·16	Looking at people directly in the eyes.
29	—·18	Talking about yourself and your feelings.
21	—·30	Making the first move in starting a friendship.
25	—·30	Taking the initiative in keeping conversation going.
24	—·33	Getting to know people in depth.

From Table 3, it can be seen that this component cuts across the 'social difficulty' dimension, with situations ranked high in difficulty appearing at both poles. This means that the component does not discriminate individuals in terms of the amount, so much as the type of difficulty they report. Thus, difficulty for one group concerns the casual, public type of social contact, while another group finds more intimate contact difficult. This suggests there are two fairly substantial groups whose social experiences are quite distinct. The first may, for instance, be reticent in initial contacts but are then able to consolidate their friendships, while the second may be more socially outgoing but less able to make deeper acquaintances.

The remaining components accounted for very small proportions of the variance, 6·3 per cent or less, and are not reported since their interpretation can only be highly speculative.

(*b*) *The persons*: In order to examine whether there were any associations between social difficulty and background characteristics of the respondents, a group of 'high difficulty' and 'low difficulty' individuals were isolated. This was done by using the first component as an indicator of social difficulty, and selecting the 30 individuals who loaded highest and the 30 who loaded lowest on it. An alternative method was to select the respondents with the highest and lowest total scores of difficulty; this was also done, and yielded substantially the same results.

(i) *Social class*. There were significantly more respondents in social classes I and II in the low difficulty group, and in social classes III, IV and V in the high difficulty group ($\chi^2=4·74$, df 1, $P<·05$). One possible explanation for this association is that since the majority of the students were from social classes I and II (about three-quarters of the sample) the students from lower social classes experienced more social difficulty than they would in a milieu predominantly of their own social class.

(ii) *Family size*. Significantly more students who were only children or who had only one sibling were in the high difficulty group than were those from larger families ($\chi^2=4·56$, df 1, $P<·05$). This may be in line with some other findings concerning only children and first borns. For example, Smith (1971) found that more students who were only children withdrew from Sussex University than those from families of two or more children. Schachter (1964) found that only children and first borns tended to be more timid, dependent and influencable, and he suggested that this would be likely to lead to more interpersonal problems.

(iii) *Nationality*. There was a trend which did not quite reach significance towards a disproportionate number of overseas students in the *low* difficulty group compared to the high difficulty group, and a further comparison between the low difficulty group and the rest of the sample produced a significant difference in this direction ($\chi^2 = 6{\cdot}81$, df 1, $P < {\cdot}01$). This association is difficult to explain, and indeed one might well have expected students from abroad to have more difficulties rather than less. However, the overseas students in the low difficulty group did not, with one exception, come from the countries which, for example, Still (1961) found to be associated with a higher incidence of psychological symptoms (the Middle East, West Africa and India).

None of the other characteristics shown in Table 1 was significantly related to social difficulty.

DISCUSSION

One question raised by this study is the relationship between social difficulty and psychological disturbance. Precipitating social factors in ' psycho-social ' disturbance has already been referred to in the introduction, and many writers claim a strong link between breakdown in social interaction and mental illness (Sullivan, 1953 ; Ryle and Breen, 1972 ; Argyle, 1969 ; Zigler and Phillips, 1960).

In the present study, taking only the most stringent estimate of difficulty, great difficulty in or avoidance of at least four situations, one in 11 students would appear to have been experiencing considerable stress. Almost all of this difficulty occurred in the situations found at the positive pole of the first component, which involved actively seeking contact with relative strangers, particularly of the opposite sex, situations of considerable importance for young, single men and women. On a 10 per cent sample, even assuming that all the non-respondents had no difficulties, this could mean as many as 190 second-year students in the university as a whole. The extent to which this degree of difficulty represents ' pathological ' social inadequacy is not known, but we suspect these may be ' at risk ' individuals.

Further information on this problem is being obtained from a more extensive study of a sample of psychiatric out-patients. One aim of this latter study is to examine the relationship firstly, between observed social inadequacy and reported social difficulty, and secondly, between these and clinical state. A second aim is to explore further the value of ' treating ' socially inadequate patients by training in social interaction skills, a method with which we have already had some success, and which might be extended to other individuals with similar difficulties, such as students.

The work we have done so far with psychiatric patients has suggested that interpersonal difficulties may be of two kinds : firstly, a lack of basic social skills which makes people unrewarding to others and leads to unsuccessful attempts at meeting people, and, secondly, problems in establishing deep relationships with others which do not appear to be due to lack of skill. These two kinds of difficulty are very similar to the two patterns of difficulty which emerged on the second component of the principal components analysis. It is the first kind, the lack of skill, which we would call social inadequacy, and which is most likely to be helped by social skills training. If the psychiatric survey yields useful results, the method described in the student survey could possibly be used to identify socially inadequate individuals.

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P2646

COMPONENTS OF OCCUPATIONAL INTEREST

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SUMMARY. The Rothwell Miller Interest Blank was completed by members of the National Survey of Health and Development, two months before their fifteenth birthday. Their scores on this inventory were subjected to a component analysis. Interpretations of the first three components are made by examining the job choices of the Survey members. The first component 'ambition' is related to home and school factors. It is shown that the social composition of the school is an important determinant of ambition at non-selective schools.

INTRODUCTION

THE National Survey is a longitudinal study of 5,362 young people who have been followed up from their birth in 1946 to the present day. Two months before their fifteenth birthday the Survey members completed a number of tests of ability and attainment, and an occupational interest inventory. The test scores have been used in two recent papers (Ross and Simpson, 1971a and 1971b) on the association between the rate of educational progress, parents' education and family size. The present paper continues the analysis by investigating the effect of home and school variables on occupational interests. Three interest components are identified. The relationship between the first component ('ambition') and the home background of the Survey member and of the other pupils at his school, is discussed.

DEVELOPING THE COMPONENTS

The occupational interests of the Survey members were indicated by their scores on the Rothwell Miller Interest Blank (Miller, 1968). The task of completing the blank requires the ranking of nine lists of 12 job titles. Each list is made up of jobs representing 12 key areas of work. The category of 'outdoor' jobs, for example, includes 'farmer' in list 1 for boys, 'explorer,' in list 4 and 'market gardener' in list 9. All 12 categories of job are included in each list of job titles and, although there are different forms of the blank for boys and girls, the 12 basic job categories are the same. Twelve interest scores, one for each area of work, are produced. It seemed possible that the occupational interests of the Survey members could be adequately represented in fewer than 12 dimensions. The scores on the interest inventory were subjected to a component analysis and three main components extracted.* Only seven of the 12 categories were substantially involved in the first three components extracted from the scores of the Survey members. These seven categories and their weightings on the three components are shown in Table 1.

The ranking of lists of job titles gives rise to scores that, even after standardisation against the scores of the whole population, retain an essentially 'ipsative' nature. This gives rise to a danger of spurious correlation. Young people who consistently rate one category of jobs as being the kind of work they would most like, must compensate by giving lower ratings to one or more other categories. It is possible that the components obtained from the correlation matrix of scores on the inventory reflect mainly the nature of the task in completing the inventory. Before the component scores can be used the non-spurious nature of all three components must therefore be demonstrated and some attempt made at interpretation.

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* Details of the analysis appear as an appendix to this paper.

TABLE 1

WEIGHTINGS OF SCORES IN THE SEVEN CATEGORIES OF WORK : FIRST THREE COMPONENTS.

Category of work	Boys			Girls		
	Component one	Component two	Component three	Component one	Component two	Component three
Mechanical ..	+0·74	+0·05	+0·42	+0·67	—0·48	+0·19
Computational	—0·35	+0·76	+0·26	+0·59	+0·68	+0·06
Scientific ..	—0·55	—0·45	+0·48	—0·74	+0·08	+0·28
Literary	—0·44	—0·17	—0·79	—0·56	—0·06	—0·75
Clerical......	—0·21	+0·86	+0·06	+0·67	+0·61	—0·10
Practical .. .	+0·91	—0·04	+0·01	+0·70	—0·54	+0·07
Medical ...	—0·64	—0·31	+0·46	—0·57	+0·14	+0·64

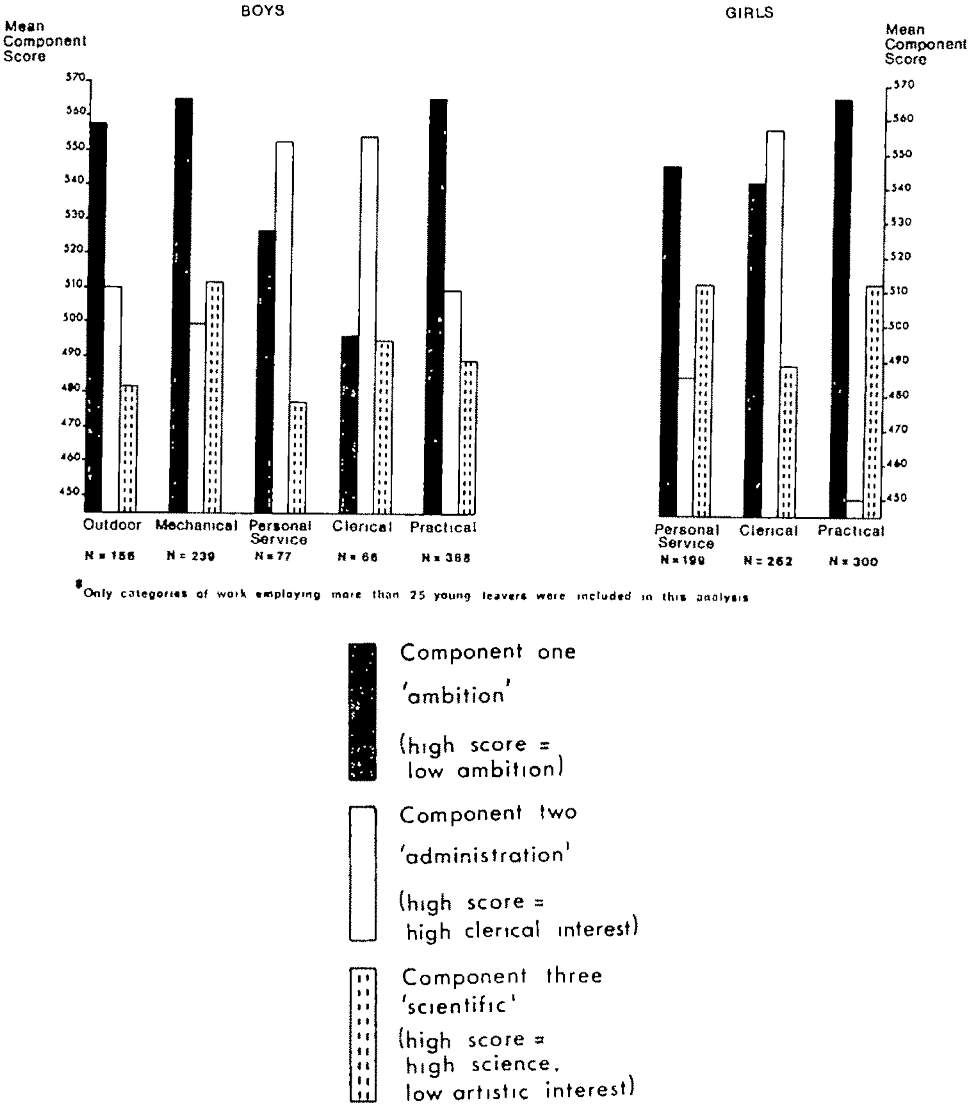
Interpretation.

Table 1 shows the weights on each of seven categories for the first three components. The first component appears, both for boys and girls, to contrast types of work that can be entered straight from school with those requiring further full-time study. This component is tentatively interpreted, from Table 1, as an ' ambition ' component, although it must be emphasised that a low score on the component would indicate an interest in working in jobs of a high status, rather than the will (or ability) to achieve them. The second component obviously contains a high clerical factor. Its interpretation is more difficult than that of the first component, but provisionally it may be interpreted as distinguishing between jobs involving administration and jobs involving action. The third component, with its very strong negative weighting on literary jobs and high science and medicine weightings, may well represent a science/arts dichotomy. While there is no *a priori* reason to suppose that components of interest for girls will be the same as for boys, these provisional interpretations are also consistent with the rather different types of work that are available, in each category, to girls.

The interpretations can be investigated further by examining the ' free choice ' of first job recorded by the young people on the same day as they completed the Interest Blank. This job was the work they hoped to get after leaving school. The jobs were later classified into one of the 12 interest categories used in the blank and the mean component scores for each type of ' free choice ' job calculated. When the categories of ' free choice ' job were ranked, for each component in turn, some indication was given of the underlying dimension represented by the component. The interpretation of Component One as ' ambition ' is supported by the order of the jobs shown in Table 2. Survey members choosing jobs requiring several years of further study are shown to have low scores (indicating high ambition). Those choosing jobs that can be entered straight from school have high mean scores on Component One. The ranking of Component Two, shown in Table 3, despite the expected high mean score of young people wanting clerical or computational jobs, provides less help in interpretation, but the provisional label of administration *versus* action still seems the most appropriate. The distinction between science and arts on Component Three is well supported by Table 4.

DIAGRAM 1

COMPONENT PROFILES OF 15 YEAR OLD SCHOOL LEAVERS ENTERING DIFFERENT TYPES* OF FIRST JOB



*Only categories of work employing more than 25 young leavers were included in this analysis

The results shown in Tables 2 to 4 suggest that the components are based on real distinctions in the mind of the young people when completing the questionnaire.

Component scores as determinants of the first job.

The component scores are also found (Diagram 1) to be related to the first job entered by young people leaving school at 15. Not all the profiles are distinct (the scores for boys entering 'outdoor' and 'practical' work are nearly identical on all three components) but a generalised analysis of dispersion suggests (P < ·001) that the type of job entered explains a significant proportion of the variance of the component scores. This result confirms the usefulness of these scores as tools of analysis, for it supports the assumption that they correspond to occupational interests that play some part in determining the first job.

TABLE 2

Component One : 'Ambition.'

Mean Component Score of Ranked 'Free Choice' of Job at Fifteen.

Boys				Girls			
Rank	Field of 'free choice' job	Score	N	Rank	Field of 'free choice' job	Score	N
1	Medical	376	56	1	Musical	384	9
2	Computational	377	48	2	Scientific	395	39
3	Social service	402	61	3	Social service	409	169
4	Scientific	403	121	4	Medical	426	197
5	Literary	417	20	5	Literary	439	27
6	Musical	430	9	6	Aesthetic	456	67
7	Clerical	458	162	7	Outdoor	460	63
8	Aesthetic	460	68	8	Personal contact	528	245
9	Personal contact	487	105	9	Clerical	532	505
10	Outdoor	507	318	10	Computational	537	46
11	Mechanical	543	611	11	Practical	549	309
12	Practical	563	329	12	Mechanical	579	65

USING THE COMPONENTS

Many theories of the development of occupational interests have been put forward but few of the models have been supported by experimental evidence. The National Survey, a large, representative sample of young people, with home and school data collected over many years, provides a good opportunity to study some of the factors influencing job choice. The isolation of three major (orthogonal) components of interest allows a more detailed use of the data collected in the National Survey than was possible with less sophisticated criteria. Using the components it will be possible to test the effect of early childhood and school experience on the three dimensions of interest. The first results, of school and home variables on ' ambition,' are discussed below.

Determinants of 'Ambition.'

All the Survey members who had completed the Interest Blank were included in this analysis. Five variables were used. They were :

(*a*) *Social Class* : This was determined by the occupation of both grandfathers and the father of the Survey member and by the education of both his parents. Details of the social class categories are given as an appendix to *All Our Future* (Douglas *et al.*, 1968).

(*b*) *School type* : The school attended by the Survey member at the time of completing the Interest Blank was categorised as being either selective (including fee-paying) or non-selective (including comprehensive). Pupils attending special schools were excluded from the analysis.

(*c*) *Ability* : The combined scores on the AH4 verbal and non-verbal tests (Heim, 1967) were taken as estimates of general ability. The scores, standardised to a mean of 50 and standard deviation of 10 were grouped into five bands of ability :

(i) less than 42,
(ii) 42–47,
(iii) 48–52,
(iv) 53–58,
(v) more than 58.

Finally, three categories ' high,' ' average ' and ' low ' were defined for each school type. At selective schools categories (i) to (iii) were combined to form a low ability group. At non-selective schools categories (iii) to (v) were combined to form a high ability group.

(*d*) *Parents' interest in secondary education* : This variable, derived from both teachers' and parents' reports of the parents' contact with the school, was found to be an important determinant of the child's academic achievement. A more detailed explanation of the variable and its explanatory power with educational data is given in *All Our Future.*

(*e*) *Social composition* : The head teacher of the school attended by the Survey member at the time of completing the Interest Blank was asked to indicate roughly the proportion of children in the school whose father's occupation was (*a*) professional, business or clerical, (*b*) skilled manual work, (*c*) agricultural work, (*d*) unskilled work or labouring. The answers to this question were combined into five categories :

(i) ½ or more non-manual,
(ii) ¼–½ non-manual, skilled ¼ or more,
(iii) ¼–½ non-manual, skilled under ¼,
(iv) less than ½ non-manual, skilled ¼ or more,
(v) unskilled or agricultural workers predominant.

The proportion of schools falling into each category differed markedly between the selective and non-selective schools. Three categories ' middle class,' ' mixed ' and ' working class ' were defined, different definitions being used for the two types of school. A selective school was labelled ' working class ' if it fell into categories (iii) to (v). A non-selective school was labelled ' middle class ' if it was in categories (i) to (iii).

TABLE 3

COMPONENT TWO: 'ADMINISTRATION/ACTION'
MEAN COMPONENT SCORE OF RANKED 'FREE CHOICE' OF JOB AT FIFTEEN.

Boys				Girls			
Rank	Field of 'free choice' job	Score	N	Rank	Field of 'free choice' job	Score	N
1	Computational ..	623	48	1	Clerical	561	505
2	Clerical	554	162	2	Computational ..	560	46
3	Personal contact ..	531	105	3	Scientific	518	39
4	Musical	520	9	4	Social service . .	498	169
5	Literary	514	20	5	Literary	496	27
6	Practical	510	329	6	Musical	489	9
7	Mechanical	494	611	7	Personal contact ..	485	245
8	Aesthetic	488	68	8	Medical	474	197
9	Social service . .	483	61	9	Aesthetic	451	67
10	Outdoor	480	318	10	Practical	451	309
11	Scientific	460	121	11	Outdoor	447	63
12	Medical	431	56	12	Mechanical	442	65

TABLE 4

COMPONENT THREE: 'ARTS/SCIENCES'
MEAN COMPONENT SCORE OF RANKED 'FREE CHOICE' OF JOB AT FIFTEEN.

Boys				Girls			
Rank	Field of 'free choice' job	Score	N	Rank	Field of 'free choice' job	Score	N
1	Scientific	576	121	1	Medical	573	197
2	Mechanical	531	611	2	Scientific	570	39
3	Medical	527	56	3	Mechanical	520	65
4	Computational ..	507	48	4	Computational ..	514	46
5	Practical	483	329	5	Outdoor	514	63
6	Clerical	481	162	6	Practical	509	309
7	Outdoor	480	318	7	Personal contact ..	492	245
8	Social service . .	466	61	8	Clerical	480	505
9	Aesthetic	463	68	9	Social Service	480	169
10	Personal contact .	450	105	10	Aesthetic	466	67
11	Musical	442	9	11	Musical	456	9
12	Literary	360	20	12	Literary	401	27

These variables were not independent and a multivariate analysis was necessary to test the effect of one variable after adjustment had been made for the other four. Comparisons of ability scores of pupils at selective and non-selective schools could be misleading and it was decided to carry out separate regression analyses for young people at each of the two types of school. The method used was one known as multiple classification analysis (Andrews *et al.*, 1969) in which constants were fitted that indicated the effect on ' ambition ' of each predictor variable, after allowance had been made for other variables included in the analysis. The procedure was essentially equivalent to a multiple regression analysis using dummy variables.

TABLE 5

MEAN ' AMBITION ' SCORES * FOR EACH VARIABLE, ADJUSTED FOR THE CORRELATIONS WITH OTHER VARIABLES.

	Non-selective schools		Selective schools	
	Boys	Girls	Boys	Girls
Social Class :				
Upper middle	478	453	410	403
Lower middle	516	511	421	433
Upper manual	521	531	443	455
Lower manual	549	548	459	475
Ability† :				
High	516	520	413	No significant effect
Average	530	526	432	
Low	544	547	439	
Parents' interest :				
High	503	508	No significant effect	428
Average	539	529		434
Low	545	557		474
Social composition† :				
Middle class	514	524	No significant effect	No significant effect
Mixed	533	531		
Working class	547	547		
Overall Mean	532	533	425	436
Standard deviation	92·5	89·3	77·6	86·6
N	1056	909	453	455

* A low score represents a high ambition.

† These variables were defined differently for the two school types and no direct comparison is appropriate.

Results.

The adjusted means of each significant variable are shown in Table 5. At non-selective schools the effect of each variable was very similar for boys and girls and the analysis was repeated for boys and girls as a single group : the detailed results of the combined analysis are shown in Table 6. All four variables are found to have a very significant effect on ' ambition.' The differences established by the multivariate analysis are readily observable in the raw data, with, for example, working class children at non-selective schools having a mean ambition score of 561 if their school is ' working class,' of 546 if it is ' mixed ' and 526 if it is a ' middle class ' school. The analysis for selective school pupils showed fewer significant factors, but social class was significant for both boys and girls (P <0·1). Ability was significant for the boys (P < ·05) but not for girls. Conversely, the interest shown by the parents in education was significant for girls (P < ·01) but not for boys. The social composition of the school did not appear to be significant in relation to 'ambition ' either for boys or girls at selective schools.

TABLE 6

DETAILS OF THE ANALYSIS OF ' AMBITION ' FOR NON-SELECTIVE SCHOOL PUPILS.

Variable	Constant	F value	Degrees of freedom	Probability less than
Overall	532·6	—	1	—
Sex	+0·08 —0·10	·002	1	—
Social class	—63·3 —18·8 —6·2 +15·8	30·7	3	·001
Ability	—15·0 —4·2 +13·2	20·3	2	·001
Parents' interest	—24·6 +1·4 +17·0	37·2	2	·001
Social composition of school	—14·0 —0·8 +14·1	11·0	2	·001

Table based on 1965 Survey members

DISCUSSION

The results reported in this paper appear to give support for the use of the interest components, despite the contra-indication of the ipsative methods of scoring used in the Interest Blank. Evidence for the effect of home and school variables on job choice is so difficult to establish that even the initial results, reported here, may be of considerable interest. In particular, the effect of school composition on ' ambition ' is relevant to decisions about comprehensive education and the catchment area for local comprehensive schools. Children from working class homes in schools with mainly working class pupils appear to have less interest in breaking with working class occupational traditions than do similar children mixing with pupils from more varied home backgrounds. Social class and the parents' interest in education are shown to be of substantial importance in determining the ambition of children at non-selective schools. If the school is to counter the effect on job choice of poor family circumstances, the area from which it draws its pupils may be important in determining the acceptability of occupational information and guidance.

These results from the National Survey imply that ease of administration is not a sufficient criterion on which to decide the catchment area of a secondary school. Where a balanced intake of middle class and working class pupils is possible, a decision on boundaries that does not take into account the social composition of the proposed areas may promote an unnecessary poverty of ambition among children attending schools with predominantly working class pupils

ACKNOWLEDGMENTS—The analysis reported in this paper is based on variables collected over many years, and in using them I am indebted to Dr. J. W. B. Douglas, Director of the National Survey. Much of the occupational data results from the work of David Nelson, now at the University of Edinburgh. Elizabeth Atkins, Colin Taylor and Sylvester Young have also given valuable advice or assistance.

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APPENDIX

Procedure adopted in the component analysis.

The ranks (between 1 and 12) assigned to a job title, in each of the nine lists, were summed, producing a total raw score between 9 and 108, for each category of work. A raw score represented the strength of a Survey member's interest in that category, relative to his interest in the other categories included in the Inventory. The raw scores were standardised by comparing the strength of one Survey member's interest in a category of work with the interest shown by other Survey members, and a standard score (equivalent to a percentile) was calculated. These scores, with a rectangular distribution and a range from 1 to 20, were used in the component analysis. A high ' percentile ' score represented a high level of interest.

The initial analysis, one for boys and one for girls, made use of the scores for all 12 categories. The results suggested that the inventory scores could be represented by three main components. Examination of the variation explained by these components also suggested that only seven of the 12 categories were substantially involved. A separate analysis of the five categories with low involvement was carried out, but no important components were apparent and these five categories were not included in the components used in this paper.

The three components extracted from the scores on the seven remaining variables represented a summary of the patterns used by the members of the National Survey in completing the Rothwell Miller Interest Blank. Although it seems likely that they represent real distinctions in the pattern of interests of young people, it is not suggested that they necessarily represent a complete and independent factorial structure.

ATTITUDES TOWARDS ACCEPTANCE OF SELF AND OTHERS AND ADJUSTMENT TO TEACHING

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SUMMARY. The hypothesis that there is a significant relationship between attitudes towards self and others and adjustment to teaching was supported by the following evidence: scales to measure the attitudes were shown to correlate consistently at the ·01 level with three different estimates of job satisfaction in three different population samples—factor analysis confirmed the relationships; the scales differentiated at the ·01 level between groups of students who had never considered withdrawal (i.e., who were well adjusted), those who had seriously considered withdrawal (less well adjusted) and those who withdrew voluntarily (unable to adjust).

INTRODUCTION

AN investigation sponsored by the ATCDE (1971) revealed that from 1967 onwards there has been an increasing rate of wastage from colleges of education. From a sample of 99 colleges, the loss over the whole course for the 1967 intake was 10·5 per cent of which 5·4 per cent was due to voluntary withdrawals. The comparable estimated figures for the 1968 intake were 12 per cent and 6 per cent, respectively. The latter figure would represent a loss of the order of 2,000 students in England and Wales as a whole.

Previous research has concentrated on success rather than on adjustment to the course and/or to teaching, although a number of recent studies have given some attention to the importance of job satisfaction: e.g., McLeish (1970) and Venables (1971). From observation over many years in schools and colleges, it appeared that those who adjusted well to teaching and to preparation for teaching, and who seemed to gain most satisfaction from it and gave most to it, were those who most readily accepted themselves and others. There are no indications in the literature that this has been investigated but this is not surprising as most studies have been designed with success rather than adjustment in mind.

An experiment was therefore designed in which scales to measure attitudes towards acceptance of self and others were used as predictors of adjustment, with estimates of expected job satisfaction as criteria. As no suitable published measure of attitude towards acceptance of self and others was available, it was first necessary to construct appropriate scales. In a supplementary experiment, the mean scores on the attitude scales obtained by students in college were compared with the mean scores obtained by students who subsequently withdrew.

The hypothesis to be tested stated that there is a significant relationship between attitudes towards acceptance of self and others and adjustment to teaching.

METHOD

A. *Construction of the Attitude Scales.*

Two separate Likert-type scales were constructed, one to measure attitude towards acceptance of self and one to measure attitude towards acceptance of others. These were presented in one schedule, the items being inter-mixed but scored separately.

The original pool of potential items was obtained chiefly from material provided by students who had been asked to write as many statements as possible about themselves and others. An item analysis was carried out in two stages with a total population of 299 students. The discriminating power of each item was tested by the use of the critical ratio (Guilford, 1954, p. 417 ; Shaw and Wright, 1967, p. 24), items being eliminated on the basis of poor discriminating power and/or high frequency of significant correlations with other items.

The final schedule contained 65 items : 38 on the acceptance of self scale and 27 on the acceptance of others. Examples are given below :

Acceptance of self :

" I expect people to take me as I am."
" I have faith in my capacity to cope with life."
*" I never feel I do justice to myself in an argument."
*" I take badly to criticism."

Acceptance of others :

" I enjoy meeting people from all walks of life."
" We have responsibilities to others as well as to ourselves."
*" Some people are just not worth bothering with."
*" I don't suffer fools gladly."
(* negative item)

The consistency of the scales was examined in a series of rest-retest situations, the results being shown in Table 1.

TABLE 1

ATTITUDE SCALES : TEST/RETEST CORRELATIONS.

N	Test/retest interval	r	
		' Self '	' Others '
96	5 weeks	·84	·83
163	5 weeks	·81	·80
110	15 months	·79	·71

B. The Main Experiment.

Three population samples were used : Group 1, 183 women under 25 ; Group 2, 113 women over 25 ; and Group 3, 53 men under 25. The two groups of young students were from College A, a large mixed college on the south coast ; the mature students attended a non-residential college on the fringe of the Greater London area.

The measures used in the main experiment, together with the stages of the course at which they were administered, are given in Table 2.

A self rating of expected job satisfaction was also originally included but failed to yield significant results. In previous attempts to use this method (e.g., Rudd and Wiseman, 1962) a marked negative skew in the score distributions rendered the results almost useless. This was again apparent in the present study even though some modification of method was introduced.

TABLE 2

THE MEASURES AND STAGES OF THE COURSE AT WHICH THEY WERE ADMINISTERED

No.	Description	Stage of course
	Attitude scales (predictor variables) :	
1	Acceptance of self	End of term 1
2	Acceptance of others	
3	Acceptance of self and others	
	Expected job satisfaction (criterion variables) :	
4	Teaching activities inventory (importance)	Term 6
5	Teaching activities inventory (interest)	
6	Tutors' rating	
7	' Teaching satisfaction ' (from 16PF) (Groups 1 and 3 only)	Before admission
8	Teaching practice grade	End of term 5

In variables 4 and 5, respondents were asked to grade 22 activities associated with teaching, firstly on importance and then on interest. This was developed from work reported by McLeish (op. cit.). The tutors' rating was obtained from a minimum of three independent assessments by tutors on the degree of expected job satisfaction of the students being rated. The teaching practice grade (variable 8) was included in order to see whether the judgments on expected satisfaction were reflecting performance in the classroom.

The Cattell 16 PF Questionnaire was administered to respondents in College A (Groups 1 and 3). Cortis (1970, p. 221) reported that ' very satisfied ' teachers score higher than others on factors A C G—friendliness, stability and conscientiousness. The sum of the sten scores on these three factors was therefore included as variable 7 with the title of ' teaching satisfaction.'

As this experiment was part of a wider investigation (Crane, 1972) the following measures, not directly relevant to the present problem, were included in the matrix:

16 PF first order factors, the second order factors of Anxiety and Exvia and a derived score ' Mental Health ' as described in IPAT bulletins nos. 8 and 9 (IPAT, 1963a and 1963b) ;

Two tests of academic aptitude (Vice-Chancellors' Committee, 1967) designed to measure the ability of sixth form pupils to apply basic verbal and mathematical skills ;

A fourth score, ' certainty,' obtained by taking into account the frequency of use of the extreme categories in the attitude scales.

The scores on all these measures for each group of students were intercorrelated and a factor analysis with varimax rotation was carried out with each matrix in turn. Altogether, there were 31 variables for Groups 1 and 3 (which included the 16 PF measures) and 11 for Group 2. As a final check the experimental independence of variables was established by appropriate eliminations (e.g., the separate scores for acceptance of self and acceptance of others) and the factor analyses recalculated.

C. *The Supplementary Experiment.*

Three groups of students were identified :

(1) Students who appeared to be well adjusted to the course and to teaching ;

(2) Students who had seriously considered withdrawal (less well adjusted) ;

(3) Students who had withdrawn (unable to adjust).

The first two groups were identified from information supplied on a questionnaire designed chiefly for use in another part of the wider investigation to which reference has been made. An option was given for the questionnaire to be answered anonymously and advantage was taken of this by the majority of students. Only those who signed the questionnaire and who answered the relevant section could therefore be allocated to an appropriate group and there were only six in each of the first two groups for whom scores were available. By chance there were also six students who had withdrawn voluntarily during the period of the inquiry.

The significance of the differences of the mean scores of the three groups on attitudes towards acceptance of self and others was tested by one-way analysis of variance and the results checked by the use of a non-parametric test (Jonckheere, 1954).

RESULTS

(i) *The Main Experiment.*

TABLE 3

PREDICTOR AND CRITERION VARIABLES : SIGNIFICANT CORRELATIONS.
(Decimal points omitted)

	Predictor variables (Attitude scales)	Criterion variables			
		4 ' Importance '	5 ' Interest '	6 Tutors' Rating	7 ' Teaching Satisfaction ' (16PF)
Group 1	1 ' Self '	44	53	38	24
	2 ' Others '................	40	46	32	16
	3 ' Self and Others '	52	62	45	26
Group 2	1 ' Self '	33	41	28	Not applicable
	2 ' Others '	22	38	27	
	3 ' Self and Others '	37	50	35	
Group 3	1 ' Self '	40	50	42	42
	2 ' Others '................	45	46	38	42
	3 ' Self and Others '	52	60	50	52

With only two exceptions, all correlations reached the ·01 level of significance.

It may be noted that when the two attitude scales were taken together (' self and others ') the correlations with the criterion variables were consistently higher than with either scale taken separately.

Whilst it can be seen from Table 3 that tutors' ratings in all groups correlated significantly with the attitude scales, teaching practice grades just as consistently failed to do so.

TABLE 4

FACTOR ANALYSIS : FACTORS WITH LOADINGS ON BOTH ACCEPTANCE AND SATISFACTION VARIABLES FOR THREE GROUPS OF STUDENTS.

Variables	Factors		
	Group 1	Group 2	Group 3
1. Acceptance of self and others	817	825	664
Expected satisfaction :			
5. Teaching activities (interest)	841	701	815
6. Tutors' rating	578	618	383
Latent roots.............................	2·08	2·07	1·87
Percentage variance	7·72	25·86	6·93

Table 4 shows that in each group a unipolar factor emerged with loadings on the remaining predictor and criterion variables after the eliminations to establish the experimental independence of variables had been carried out.

(ii) *The Supplementary Experiment.*

Differences in the mean scores of three groups of students on scales to measure attitude towards acceptance of self and others showed a trend in the order, well adjusted group higher than less well adjusted group, in turn higher than the group who were unable to adjust. These differences were significant at the ·01 level when tested both by one-way analysis of variance and a non-parametric trend test. The mean scores on the attitudes taken separately showed the same tendency but in some cases less significantly.

COMMENT

To understand the choice of criterion in the main experiment (expected job satisfaction) it is necessary to note that the starting point of the inquiry was concerned with the increasing number of students who withdrew from the course voluntarily giving the reason that they no longer wished to teach. Although the task of identifying such students at interview is well nigh impossible in the present stage of knowledge, it was considered that there would be a high proportion of students with a poor opinion of themselves and others in such a group. Conversely, students with a good opinion of themselves and others would be unlikely to withdraw for this type of reason. From many years' experience, this is not at all obvious to interviewers, who tend to ignore the issue.

It, therefore, seemed appropriate to set up an experiment to see if a relationship could be shown to exist. Given the circumstances there was no obvious alternative criterion to expected job satisfaction. It should be noted that responses, with one exception, were made after nearly two years in college and were thus based on some evidence of what is involved in teaching. Performance was obviously inappropriate and it has been noted that there is no significant relationship between teaching practice grades and the attitude scales.

On the question of validity two different types of measure, one based on the judgments of experienced tutors, correlated significantly and consistently with the predictor variable. Thus, more than a general skill in responding to inventories was involved. The measures based on inventory response were in any case similar to those used successfully by McLeish (op. cit.) to indicate job satisfaction.

Although the numbers were small, the supplementary experiment showed that the attitude scales differentiated between groups of students who, on grounds other than estimates of expected job satisfaction, showed differing degrees of adjustment to teaching. Furthermore, it showed that the more interesting group—those who withdrew, had significantly worse opinions of themselves and others than the groups still in college.

Finally, in both experiments, the two attitudes taken together gave more convincing results than when either was taken separately.

CONCLUSIONS

The hypothesis that there is a significant relationship between attitudes towards acceptance of self and others and adjustment to teaching was supported by the following evidence:

(i) Scales to measure attitudes towards acceptance of self and others, when used in combination, were shown to correlate consistently at the ·01 level of significance with four different estimates of expected job satisfaction in three different population samples. The correlation coefficients ranged from ·35 to ·62.

(ii) Factor analysis confirmed these relationships: with each of the population samples, a unipolar factor emerged with substantial loadings on the attitude scale and job satisfaction variables.

(iii) The combined attitude scales differentiated at the ·01 level of significance between three groups of students who gave evidence of differing degrees of adjustment to teaching.

It may therefore be claimed that within the limits of the investigation, a significant relationship has been shown to exist between attitudes towards acceptance of self and others and adjustment to teaching.

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LATERALITY AND THE GROWTH OF INTELLECTUAL ABILITIES

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SUMMARY. A random sample of right-handed children and a population sample of left-handed children, including over 100 subjects in each group, were assessed for vocabulary, drawing, maze tracing and for laterality of hand, eye and foot. Reading quotients were available for 145 children. The data were examined in two ways. The first compared the abilities of laterality groups over the total sample and found no significant differences. The second assessed the laterality of children at the lower extreme of the ability distribution and found a slight excess of left handers. A brief survey of the literature shows that a distinction between studies according to their resemblance to these two analyses could help to account for the coexistence of positive and negative findings. Possible causes of the excess of children with sinistral tendencies in groups selected for educational disabilities are discussed with special reference to a theory of the determination of handedness (Annett, 1972) which permits a restatement of the maturational lag hypothesis of developmental language delay.

INTRODUCTION

THE reasons for making a study of relations between handedness, other functional asymmetries, and aspects of intellectual growth when so many are already reported (Vernon, 1957; Bakker and Satz, 1970) must be specified clearly. This paper has two purposes. The first is to describe findings which can account for the coexistence of positive and negative results in previous reports. The second is to show how the findings can be explained by a theory of the origin of handedness (Annett, 1972).

In an analysis of vocabulary test scores in children, Annett (1970b) found both positive and negative findings with respect to laterality depending on the ways in which the data were examined. When the whole random sample was classified for laterality and these groups were compared for vocabulary, there were no clearly significant differences. When children at the lower extreme of the vocabulary distribution were examined separately, a small but statistically significant increase in the proportion of mixed handers was found. These two approaches can be thought of as exemplifying two main streams of research into the relation between laterality and ability, one based on the normal population of school children and one based on children referred to clinics for special disabilities. Harris (1947) and Benton (1962) recognised that samples drawn from these two sources might differ. The findings described above suggest that different conclusions may be drawn from the two analagous approaches to the same sample.

Examples of studies taking the first approach, classifying general samples of children for laterality and finding no differences with respect to ability, are those of Clark (1970) for reading backwardness, Stephens (1967) for reading readiness, Reed and Smith (1962) for writing speed, Brenner and Gillman (1966) for visuo-motor ability and Allison (1966) for several scholastic attainments. The second approach, through children selected for disabilities and compared with control children for laterality, has found an increased incidence of left or mixed handedness in those of subnormal intelligence (Gordon, 1921; Burt, 1958), in children with some types of speech defect (Morley, 1972 ; Ingram, 1959), in younger but not older backward readers (Granjon-Galifret and Ajuriaguerra, 1951 ; Harris, 1957) and in children with specific dyslexia (Naidoo, 1972). Other reports of anomalous laterality in children with language problems have been made by Creak (1936), Orton (1937), McFie (1952), Wussler and Barclay (1970) and Bryden (1970). All these positive reports depend on a relatively small increase in the proportion of children with sinistral tendencies in groups with clear educational difficulties. It is to be expected that a small difference would not always be detected, especially when control groups number not more than about 50 cases (Belmont and Birch, 1965 ; Coleman and Deutsch, 1964 ; Lyle, 1968 ; Sparrow and Satz, 1970 ; Trieschmann, 1966) when the number of actions examined is few (Rutter, Tizard and Whitmore, 1970) or when the selected children include the mildly retarded (as appears to have been the case of Witty and Kopel, 1936; Gates and Bond, 1936 ; and Dearborn, 1939). In summary, it may be said that variations in ability are not characteristic of laterality groups in the general population but that anomalies of laterality are sometimes, but not always detected in children selected for educational disability. Positive findings, when present, apply to a small increase in the incidence of left or mixed handedness in the latter type of sample.

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The investigation reported below was designed in the first place to check the observation that negative findings with respect to laterality are associated with the analysis of vocabulary in a general sample of school children and positive ones with children at the lower range of the distribution. A second purpose was to compare these two analyses for assessments of non-verbal ability. A third purpose was to check whether differences between verbal and non-verbal abilities vary with handedness as suggested by Levy (1969) and Miller (1971).

In order to obtain unbiased samples of right and left handers, with sufficient numbers of each type, an initial sample of all children in each school was selected according to birthday ; this was supplemented by the addition of all other children known to be left handed writers. The total group is not representative, therefore, of the laterality distribution of the general population.

The classification of handedness follows the senior author's previous work (Annett, 1967 ; 1970a and 1970b) in separating pure right handers and pure left handers, who perform all actions tested consistently with one hand, and mixed handers whose preference varies between tasks. Mixed handers are also divided into right handed writers and left handed writers, giving a total of four handedness groups.

PROCEDURE

Children were examined individually, two children being seen by two examiners (the authors) simultaneously in adjoining rooms, or in the same room and taking care that each child's attention was fully engaged on the tasks in progress. The children were brought from their classes in pairs and one of each pair began with the vocabulary, drawing and lateral preference tasks given by one examiner while the other began with the peg moving and maze tests given by the other examiner ; the children then changed examiners to complete the tests. Details of the tasks are as follows :

Lateral Preference. The child was asked to perform five unimanual actions, drawing, throwing a ball, cutting with scissors, hammering a nail into wood with a toy hammer and placing small buttons into a narrow necked bottle. He was asked to look at a distant object through a tube and to pretend to kick a football.

Peg Moving. This task requires 10 dowelling pegs to be moved from one row to another 8 inches away, using one hand and taking one peg at a time (Annett, 1970b). Time was measured by stop watch for three trials with each hand, hands alternating between trials and half the children starting with the right hand and half with the left.

Vocabulary. The Peabody Picture Vocabulary Test (Dunn, 1959) was given as described by Annett (1970b).

Draw-a-Man. Each child was asked to 'Draw the best man you can,' and the drawing was scored according to the original method of Goodenough (1926) and also according to the revised method of Harris (1963). The results were similar for both methods but the means given by the Goodenough scoring were closer to 100 and these scores only are reported below. (For 224 subjects the mean IQs were for Goodenough scoring, 102±18, and for Harris scoring, 94±14.)

Maze Tests. For children up to 5 years, the maze test of the Wechsler scale for pre-school and primary children (Wechsler, 1963) was used and for others the maze test from the Wechsler scale for children (Wechsler, 1949).

Reading Quotient. The reading attainment of older children had been measured by their head teachers using standardised tests. The quotient recorded on the most recent test was noted for each child of 8 years and over.

SUBJECTS

Children were drawn from one city nursery school and from four mixed infant and junior schools in a village which serves as a suburb of the city. Children in the age selected sample were near to their 5th, 6th, 8th and 10th birthdays. The additional children were all those between 5–11 years who wrote with the left hand. Table 1 gives the numbers of children in the four handedness groups ; the totals are also shown divided by sample, by sex and by age (under 8 years and 8 plus). There are sufficient numbers in the handedness groups to make the required comparisons and the sexes and ages are adequately represented in each group. There are more females than males in the total sample (104 males, 120 females) and the number of left-handed females is a little higher than than of left handed males (54 males, 57 females). The proportion of females who are left handed is slightly but not significantly less than that of males who are left handed.

TABLE 1

THE SAMPLE.

	Handedness			
	Pure Right	Mixed Right	Mixed Left	Pure Left
Total	83	30	74	37
Total divided by sample :				
Age Sample	83	30	13	9
Additional Left-handed writers			61	28
Total divided by sex :				
Males	38	12	38	16
Females	45	18	36	21
Total divided by age				
<8 years	46	17	33	20
8 years+	37	13	41	17

RESULTS

Laterality.

The hand preference distribution given in Table 1 shows that of the 113 dextral writers nearly three-quarters were pure right handers and of the 111 sinistral writers exactly one-third were pure left handers. The proportions of right, mixed and left handers in the sex and age groups are similar. The slightly greater proportion of left handed males, especially evident in the random sample, is consistent with earlier findings (Annett, 1970b). The proportion of mixed handers is a little larger, certainly not smaller, in the older than younger children confirming the earlier finding that the incidence of mixed handedness does not decline with increasing age (Annett, 1970b).

Table 2 describes the hand preference groups for manual speed and for the percentages of children who are left eyed and left footed. The manual speeds confirm that pure right and pure left handers are equally asymmetrical to the right and to the left on this measure of manual skill; mixed right and mixed left handers also are equally asymmetrical but closer to the point of symmetry between hands than pure handers. The data for sighting and kicking show an increase in the proportions of children who are sinistral in these respects with increasing degrees of left hand preference. Comparing the right and left handers for right and left eye sighting gives a chi square of 16·1 (with 1 df, $P < \cdot 001$) and the corresponding dichotomies of hand and foot preference give a chi square of 80.

TABLE 2

MANUAL SPEED DIFFERENCES, EYEDNESS AND FOOTEDNESS IN HANDEDNESS GROUPS

		Handedness			
		Pure Right	Mixed Right	Mixed Left	Pure Left
	N	83	30	74	37
Left minus Right hand time for peg moving in secs.	Mean .	1·78	·87	—·92	—1·82
	SD .	1·25	1·21	1·33	1·33
Left eyed sighting ...	Per cent	36·1	23·3	55·4	67·6
Left footed kicking ..	Per cent	3·8	13·3	52·7	83·8

Laterality and Levels of Ability.

Table 3 gives the mean vocabulary, Draw-a-Man, maze and reading scores in the hand preference groups. All means are very similar and there are no significant differences between groups. Separate analyses for each sex and for each age group found no significant differences in any comparison.

The mean test scores were also compared between children who were right and left eyed and between those who were right and left footed. The means are alike in both analyses. Children were also grouped into those who were consistently right handed, right eyed and right footed, those who were right handed but showed left preference for eye or foot, and similarly those who were consistently or inconsistently left sided. Again, no significant differences were found between groups.

TABLE 3

TEST SCORES IN HANDEDNESS GROUPS.

		Handedness			
		Pure Right	Mixed Right	Mixed Left	Pure Left
	N	83	30	74	37
Vocabulary Test IQ . .	Mean ..	108·5	107·9	107·9	106·1
	SD . . .	18·7	13·7	18·9	17·3
Draw-a-Man IQ	Mean ..	102·8	102·9	100·7	101·7
	SD ...	17·3	16·6	20·5	17·4
Maze Test Scaled Score	Mean ...	10·9	11·0	10·7	11·4
	SD . ..	2·8	2·0	2·2	2·9
Reading Quotient	N	51	15	53	26
	Mean . .	107·7	107·1	109·3	107·1
	SD	22·7	17·9	21·4	25·3

Laterality and the Differences between Verbal and Non-Verbal Test Scores.

Differences between scores obtained on the vocabulary and other tests were examined in several ways. The difference between vocabulary and Draw-a-Man IQ was calculated for each child and also the difference between the vocabulary and the maze score (with the vocabulary IQ coded so as to be comparable with the maze scaled scores). The differences were then analysed in laterality groups, taking the sign of the difference into account and also ignoring the sign. The latter was to check whether some groups tend to have larger differences between scores although children might differ within groups as to the higher score. All of these analyses produced remarkably similar results for all subgroups and no significant differences were found. The mean vocabulary minus Draw-a-Man score in 113 right handers was 5·7±21 and in 111 left handers, 6·2±22. The vocabulary minus maze score for the right handers was 0·4±5 and for the left handers 0·6±4.

Laterality and Intellectual Handicap.

Table 4 gives the numbers and percentages of right handed writers and of left handed writers obtaining very low scores on each test. It also gives this information for those having very low reading quotients and for those whose reading quotient was 30 points or more below their vocabulary IQ. This last analysis excludes all children with very low vocabulary IQ (the lowest in this group being 81), and selects children with a marked difficulty in reading.

Among children with low vocabulary scores the proportion of left handers was higher than that of right handers as predicted The numbers in both groups were small and the comparison is not statistically significant but it is the direction expected if children with problems of language development tend to include an excess of sinistrals. The comparison for specific reading disability shows that the proportion of left handers with this problem was more than twice as high as that of right handers. The chi square, 3·05, df 1, has a probability of chance occurrence of one in 10 on a two-tailed test but it could be interpreted as having a probability of less than one in 20 since the direction of the effect was predicted. The low scorers on the Draw-a-Man and Reading Quotient analyses show a slight but non-significant excess of left handers.

TABLE 4

Low Scorers Among Right and Left Handed Writers.

		Handedness for Writing	
		Right	Left
	Total N	113	111
Vocabulary IQ less than 80	N	3	6
	per cent	2·6	5·4
Draw-a-Man IQ less than 80	N	9	12
	per cent	8·0	10·8
Maze Test Scaled score	N	10	8
	per cent	8·9	7·2
Reading Quotient	Total N	66	79
RQ less than 80	N	5	8
	per cent	7.6	10·1
RQ 30 points or more below vocab. IQ	N	4	12
	per cent	6·1	15·2

The sex ratio in the low scoring groups was about equal for the Draw-a-Man and Maze tests. In the low vocabulary group there were more females (1 male, 8 female). Among those with reading quotients below 80, that is in the general group of backward readers, there were slightly more males than females (8 males, 5 females). In the specific reading disability group there was a marked excess of males (12 males, 4 females). Calculated as a proportion of males and females for whom reading quotients were available, the ratio of males to females in this group was 3·5 : 1 which is almost identical with that found in other groups with specific reading disability (Clark, 1970 ; Rutter *et al.*, 1970). The excess of males in the present group cannot be attributed to an excess of male left handers as there were slightly more left handed females than males in the sample. The proportion of right to left handers with specific reading disability was identical for both sexes (3 right, 9 left males and 1 right, 3 left females).

DISCUSSION

(1) *The Findings.*

The findings for hand preference and for relative manual speed in preference groups are consistent with earlier ones (Annett, 1970b). The large number of left handers demonstrates particularly clearly that pure and mixed left handers are as asymmetrical to the left in manual speed as pure right and mixed right handers are to the right and also that sighting and kicking are correlated with handedness. In previous studies finding no association between handedness and eyedness (Clark, 1957 ; Gronwall and Sampson, 1971 ; Merrell, 1957) few left handers were included. The present results agree with earlier ones in showing that about a third of right handers are left eyed but they also show that a similar proportion of left handers are right eyed.

The findings as to laterality and ability agree with those of the former study in showing first, that ability does not vary with laterality in the general sample but, second, that there is a slight excess of left handers among those of low ability. The comparison of laterality groups over the whole sample found very similar levels of attainment in vocabulary, drawing, maze tracing and reading. This was true of each sex and of younger and older children. The groups were similar also in the distribution of differences between tests. There is no evidence that left or mixed handed children are typically poorer than right handed children in levels of skill on verbal or on non-verbal tests. Reports of a selective disability of left or mixed handers on non-verbal tests were based on university samples (Levy, 1969 ; Miller, 1971). In a study of 282 undergraduates at the University of Aberdeen (Annett, unpublished), no differences were found between laterality groups on a vocabulary or a visuo-spatial test.

Children in the lower region of the ability distribution included a slightly higher proportion of left handers for all tests except mazes. The differences did not approach statistical significance except for children with specific reading disability. Previous studies of children selected for reading and other language difficulties, reviewed in the introduction, include some with significant findings and others with non-significant ones. It may be concluded that there is a trend toward a greater proportion of children with sinistral tendencies in those with specific language disabilities, that the effect is small and that it is not always detectable. A theoretical explanation of how such an effect could occur is offered below.

(2) *An Explanation through a Theory of the Origin of Handedness.*

In addition to the natural determinants of handedness, to be considered below, hand preference may be affected by pathological influences on early development. Although accidental damage to the CNS is probably equally likely to affect either hemisphere, the small proportion of natural left handers means that brain damaged children are represented in a much larger proportion of sinistrals than dextrals (Satz, 1972). This hypothesis could account for the higher incidence of sinistrality in the subnormal. Minimal cerebral damage could also be involved in some children with specific difficulties of speech and reading but in many studies no evidence of such damage could be found (Critchley, 1970 ; Franklin, 1962 ; Ingram *et al.*, 1970 ; Keeney and Keeney, 1968). The fact that children with specific reading disabilities tend to have a family history of reading backwardness (Ingram *et al.*, 1970 ; Hallgren, 1950 ; Naidoo, 1972 ; Rutter *et al.*, 1970) suggests that systematic rather than accidental influences are involved in many cases.

The main alternative to the hypothesis of accidental trauma to the CNS is the suggestion that in some children language acquisition is delayed by a late maturation of underlying cerebral function. Mixed handedness has often been regarded as a sympton of developmental immaturity and the association between language delay and increased sinistral tendencies was attributed to slow maturation underlying both phenomena. Several problems are raised by this interpretation. The first is that the incidence of mixed handedness does not decrease with age (Annett, 1970a and 1970b and above). Secondly, the majority of mixed handers do not have reading difficulties and many poor readers are consistently right sided (Zangwill, 1962). A third problem is that it is difficult to see how delayed maturation could affect language growth specifically and not other aspects of intelligence (Vernon, 1957). It has been argued that other abilities are probably also affected, all of them probably depending on left hemisphere function (Satz and Sparrow 1970). The maturational lag hypothesis must be able to account for three things, first, that the delay depends on a naturally occurring variant of cerebral function, secondly, that the delay is fairly specific to language functions and, thirdly, that it is associated with a slight increase in sinistral tendencies without implying that all left and mixed handers are at risk. All these requirements can be met in a restatement of the maturational lag hypothesis which follows from an analysis of the probable determination of handedness.

A survey of the main facts established about lateral asymmetry in man and in other species has suggested that two underlying determinants may be involved (Annett 1972). The first is accidental variation which produces a normal distribution of differences between sides in all species manifesting laterality. The second is a factor specific to man which shifts the distribution as a whole toward dextrality. This right shift factor can probably be identified with whatever usually induces left hemisphere specialisation for speech. A systematic bias cannot be accidental ; it probably has a genetic basis although social pressures may contribute to the number of right handers. From a distribution of right, mixed and left sidedness in animals approximating 25, 50, 25 per cent the human distribution becomes about 66, 30, 4 per cent. Human *mixed* handedness is probably a product in most cases of an accidental bias toward the left hand and an advantage to the right hand conferred by some special feature of the left hemisphere. In most mixed handers, who represent almost a third of the population and include many left handed writers, the right shift factor is probably present. The right shift factor is probably more effective in females since there is a slightly higher incidence of dextrality and a much lower incidence of speech and reading defects in females than males.

If it is assumed that in some individuals the right shift factor is weak or absent and that in these cases speech may develop in either or both hemispheres, the incidence of left and right brainedness in right and left handers can probably be accounted for (Annett, 1972). When the right shift factor is missing, the development of speech and other language skills would be expected to be delayed and the distribution of hand preferences would depend on accidental variation alone, as in other species. This implies that about equal numbers of right and left handers should occur but the majority would be without strong preferences. Brain (1945) wrote, " The abnormal handedness which so often goes with congenital speech disorders means in my view that incomplete development of the speech pathways has left the child without normal hemisphere dominance on either side." The present analysis suggests that ' normal hemisphere dominance ' depends on some factor, probably genetic, which gives the left hemisphere an advantage in the acquisition of language skills and which incidentally biases handedness toward dextrality. In the absence of this factor language growth proceeds without the aid of some special facility enjoyed by the majority, and handedness lacks the usual bias to the right. The excess of left and mixed handers in cases of specific language delay would be expected, without any implication that the right shift factor is absent in the majority of left and mixed handers.

This theory fulfils the main requirements listed above in that it shows how a maturational lag, specific to language skills, might occur as a natural variant of cerebral organisation and be associated with a higher incidence of mixed and left handedness. This condition does not imply any defect or pathological process but depends rather on the absence of some special aid to language growth. Those without this aid must vary widely in their rate of language acquisition, presumably depending on general intelligence and educational opportunity. Some probably avoid being labelled backward although they may be slower than other members of their families and may have persistent problems with the highest aspects of language achievement, such as spelling infrequent words. Children without the special facility of the majority will always be a challenge to educators because they need to be taught things which the majority do not. Analyses of what has to be taught are a source of clues as to the differences in language organisation between those with and without the special language facility or right shift factor.

Finally, it must be stressed that the theory of a right shift factor which is present in most but not all individuals was developed to account for facts other than the ones to which it has been applied here. The basic idea that human handedness is distributed in two subgroups, a majority whose handedness is normally distributed and shifted to the right and a minority whose handedness is normally distributed and not shifted to the right, has several implications, which need to be tested in further research.

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THE HIERARCHICAL FACTOR STRUCTURE OF THE WECHSLER ADULT INTELLIGENCE SCALE

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SUMMARY. A Wherry-Wherry (1969) hierarchical factor solution was obtained on WAIS subtest intercorrelations reported by Wechsler (1955, 1958) and Doppelt and Wallace (1955) for the following age groups: 16–17, 18–19, 25–34, 45–54, 60–64, 65–69, 70–74 and 75+. An hierarchical arrangement of abilities highly congruent with Vernon's (1950) paradigm of cognitive structure was obtained. A strong g-factor and two major group factors were clearly evident at all age levels. The g-factor was defined by substantial loadings from all subtests at all age levels. Removal of variance attributable to g produced almost complete bifurcation between verbal and performance subtests. Verbal subtests at all age levels defined v : ed ; performance subtests at all age levels defined k : m. A slight but consistent decrease in g-variance beyond the mid-50s was evident. This gradual decrease in g-variance was accompanied by a parallel increase in variance attributable to the two major group factors.

INTRODUCTION

THE Wechsler intelligence scales have received considerable attention from factor analysts since publication of the original Wechsler-Bellevue in 1939. The factorial composition of the Wechsler scales has been investigated by Balinsky (1941), Hover (1059), Hammer (1950), Birren (1952), Cohen (1952b, 1957b, 1959), Adcock *et al.* (1950), Gault (1954), Davis (1956), and Saunders (1959, 1960a, 1960b). However, these studies failed to show a consistent pattern which the clinician and educator can accept with confidence as a guideline for psychological assessment of both normal and atypical subjects.

From the standpoint of psychological assessment, the most noteworthy research is that of Cohen (1952a, 1952b, 1957a, 1957b, 1959) which illustrates several desirable characteristics. First, he employed the same methodology at all age levels which provides a consistent frame of reference for viewing cognitive structure. Second, he used a developmental frame of reference which remains sensitive to changes in cognitive structure from childhood through old age. Third, he developed a rationale for interpreting both WISC and WAIS profiles across age levels. The popularity of Cohen's formations is well illustrated by the extent to which his ideas and research are cited in a recent volume by Glasser and Zimmerman (1967) on interpretation of WISC profiles and performance characteristics.

The results of Cohen's (1952b, 1957b, 1959) analyses of the WISC, WAIS and W–B indicated the presence of a strong g-factor and four or five oblique primary factors at all age levels. Two highly correlated oblique verbal comprehension factors were obtained from the WISC but only one verbal comprehension factor was obtained for the W–B and WAIS. Verbal Comprehension I from the WISC was defined as " . . . verbally retained knowledge impressed by formal education " (1959, p. 286) while Verbal Comprehension II from the WISC was defined as "the application of judgment to situations following implicit verbal manipulation " (ibid., 288). A perceptual organisation factor was also consistently obtained by Cohen who noted that it required " . . . interpretation and/or organisation of visually perceived materials against a time limit " (ibid., 287). The fourth factor, freedom from distractibility, was defined as the ability " . . . which makes it possible for problem elements to 'register' and to be maintained without loss in the course of manipulation, i.e., the ability to attend or concentrate " (1952a, p. 272). Finally, two weak quasi-specific factors defined respectively by Digit Symbol and Picture Arrangement rounded out Cohen's factors.

The present study is, in many ways, congruent with the research strategy employed by Cohen. However, two major differences are evident. First, the study is derived from a hierarchical orientation to intelligence research in general and the structural pardigm of P. E. Vernon (1950) in specific. Researchers with a hierarchical orientation share a common concern which distinguishes them from other factor analysts. They are not satisfied with merely identifying the basic dimensions of intelligence but insist on going beyond this stage to determine structural relationships among the basic dimensions.

Second, the present study differs from those of Cohen with respect to method used in determining the factor solution. Cohen (1952b, 1957b, 1959) employed the centroid method to extract factors which were rotated graphically to attain Thurstone's (1947) criteria for simple structure and positive manifold. A second-order analysis was performed on the oblique primaries to obtain g-factor loadings. In contrast, a computer solution developed by Wherry and Wherry (1969) was used in the present study.

The Wherry-Wherry (1969) method provides an objective procedure for obtaining a hierarchical arrangement of abilities if such an arrangement is justified by the data. Earlier methods for determining a hierarchical solution were not always satisfactory. The procedures developed by Burt (1950) and Thomson (1951) did not provide for obtaining subgeneral factors. The Schmid-Leiman (1957) method required obtaining a factor solution at each hierarchical level and subsequent rotation to oblique simple structure. The Wherry (1959) solution eliminated the need for preliminary factor solutions and subsequent rotation at each level but still lacked objectivity since it required guessing communalities and *a priori* clustering of variables.

The Wherry-Wherry (1969) method eliminates the subjectivity of the Wherry (1959) solution by employing a principal-factor analysis with Minres cleanup to estimate communalities and a varimax rotation for assigning variables to clusters. Thus, the Wherry-Wherry (1969) procedure subsumes the original Wherry (1959) solution which is used after obtaining preliminary communality estimates and clusters. The original Wherry (1959) solution is predicated on the assumption that removal of all overlap from clusters results in orthogonal simple structure on the part of cluster specifics with respect to one another. This assumption justifies sequential multiple-group factorisation of variable and successive cluster intercorrelations until a single cluster defining the general factor is obtained. The back-solution phase then transforms the factor structure for each hierarchical level back to the first-order domain.

The major advantage of the Wherry-Wherry (1969) hierarchical solution is that it provides an objective procedure for examining the structural relations among abilities. The investigator controls factorisation through specifying minimum eigen values and maximum residuals for both primary and higher order factors and/or indicating the number of factors to be extracted at the primary level. In addition, this solution maintains orthogonality among factors at all hierarchical levels which means that the proportion of variable variance attributable to factors at the respective levels is readily obtainable from the factor structure. The solution also eliminates the interpretational problems associated with inferred second-order factors common to oblique solutions.

The factor structure of the WAIS (Wechsler, 1955) has not been investigated by an objective method which shows how factors are arranged hierarchically as well as the relative importance of factors at the various levels. Consequently, the extent to which Vernon's (1950) structure-of-intellect paradigm applies to the WAIS across age levels from early adulthood through old age remains undetermined.

On the basis of the Vernon (1950) paradigm one would hypothesise an ability hierarchy consisting of a strong g-factor and two major group factors. The purpose of the present study was, therefore, to determine the ability organisation for adults of various ages through a hierarchical factor analysis of WAIS subtest intercorrelations for subjects from early adulthood through old age.

DATA ANALYSIS

Data for the present study consisted of WAIS subtest intercorrelations reported by Wechsler (1955, 1958) and Doppelt and Wallace (1955). Subtest intercorrelations for 200 subjects ages 18–19, 300 subjects ages 25–34, and 300 subjects 45–54 were reported by Wechsler (1955, pp. 15–17) for his standardisation samples. Wechsler (1958, p. 255) also reported intercorrelations for 200 subjects ages 16–17 from the standardisation sample. Doppelt and Wallace (1955, pp. 324-327) reported intercorrelations for the following age groups. 101 subjects ages 60–64, 86 subjects ages 65–69, 80 subjects ages 70–74, and 85 subjects ages 75 and older.

A Wherry-Wherry (1969) hierarchical factor solution was obtained on the intercorrelation matrix for each of the eight age groups described above.

RESULTS.

Examination of the factor structure for WAIS subtests from early adulthood through old age strongly suggested a hierarchical ability arrangement consonant with Vernon's (1950) paradigm. The three hypothesised factors were obtained at each level. A strong g-factor was defined by positive loadings from all subtests at all age levels. Two major group factors, v : ed and k : m, were obtained. Removal of variance attributable to g resulted in almost complete bifurcation between verbal and performance subtests with the former defining v : ed and the latter defining k : m. The configuration of subtests defining these three factors, in conjunction with the magnitude of their respective loadings, suggested a relatively stable cognitive structure throughout adulthood. Beyond ages 45–54 there was a slight but consistent tendency for g-variance to decrease along with a corresponding increase in variance attributable to the two major group factors.

Description of Factor Structure.

The higher order factor was readily equated with the construct general intelligence (*g*) which has figured prominently in factor analytic research since its initial formation by Spearman (1904). Hierarchical theorists such as Burt (1949), Vernon (1950) and Thomson (1951) have placed g in proper perspective by delineating group factors at various levels and extending the interpretation of g itself. Within the framework of contemporary hierarchical theory, g is implicitly defined as the pervasive overlap among diverse intelligence assessors. The configuration of WAIS subtests loading the present factor is clearly congruent with g as implicitly defined by hierarchical theorists. Furthermore, the g-factor of the present study is congruent with other factor analyses of the Wechsler scales. Cohen (1957b, 1959) consistently obtained a strong second-order general factor in investigations of the WISC and WAIS across all age groups.

All 11 WAIS subtests showed a pattern of strong positive loadings on the g-factor at each of the eight age levels (see Table 1). The magnitude of g-factor loadings remained stable through the 45-54 age group but beyond this age there was a slight but consistent tendency for g-factor loadings to decrease in magnitude. This tendency was consistently reflected by decreased g-factor loadings by both verbal and performance subtests but the drop was somewhat sharper for the performance subtests. The magnitude of this decrease in g-factor loadings was not particularly noteworthy by itself but the consistency of the trend was more impressive and suggested a slight but systematic decrease in g beyond the mid-50's. To the extent that g indicates overall cognitive efficiency, number of cognitive bonds, and/or ability integration, there appears to be a slow but consistent loss of mental efficiency with increased age beyond the mid-50's. This tendency may indicate either a slow mental decline for ageing individuals as a group or more pronounced decline for a specific subgroup.

TABLE 1

WAIS Subtest Loading on g-Factor Across Age Groups.

Subtest	Age								Mean Loading
	16–17	18–19	25–34	45–54	60–64	65–69	70–74	75+	
Verbal:									
Information	81	83	84	85	82	84	74	75	81
Comprehension	76	71	72	78	70	66	63	66	70
Arithmetic	74	68	66	76	74	72	69	69	71
Similarities	75	79	75	76	70	67	69	63	72
Digit Span	62	60	56	62	55	54	60	55	58
Vocabulary	83	83	84	85	79	83	79	70	81
Mean Loading Verbal	75	74	73	77	72	71	69	66	72
Performance:									
Digit Symbol	57	67	63	69	75	72	70	67	67
Picture Completion	72	73	73	77	69	67	71	58	70
Block Design	76	72	71	70	79	71	59	64	70
Picture Arrangement	70	66	72	72	69	74	58	48	66
Object Assembly ..	56	66	61	68	65	57	50	60	60
Mean Loading-Performance	66	69	68	71	71	68	62	59	67
Mean Loading-All Subtests	71	71	71	74	72	70	66	63	70

Note—Decimal points are omitted.

The verbal subtests consistently loaded the g-factor more highly than the performance subtests despite the influence of Digit Span which was the poorest overall measure of g. That is, Digit Span depressed the average verbal subtest loading and obfuscated the overall superiority of the remaining five verbal subtests as measures of g Vocabulary and Information loaded the g-factor most highly at all age levels ; Digit Span and Object Assembly loaded lowest ; and the remaining subtests tended to load at an intermediate level.

At the subgeneral level almost complete bifurcation occurred between verbal and performance subtests. After removal of variance attributable to g the verbal and performance subtests divided into two group factors. The ability arrangement of the present study is highly congruent with the research of British factor analysts who have determined two major group factors which fall directly below g in the ability hierarchy.

Inspection of subtest loadings for the factor summarised in Table 2 clearly suggested that it can be equated with the verbal-educational (v : ed) ability of Vernon's (1950) hierarchical paradigm. The configuration of positive loadings from verbal subtests at all age levels is congruent with British interpretations of v : ed as the cumulative effect of a relatively uniform educational curriculum. This factor includes the application of verbal skills and information to the solution of new problems as well as the verbal skills and information themselves. The Vocabulary and Information subtests consistently provide the best measures of v : ed regardless of age level. However, at any age level the sum of the verbal subtests should provide a fairly satisfactory estimate of v : ed for normal subjects.

TABLE 2

WAIS SUBTEST LOADING ON V : ED-FACTOR ACROSS AGE GROUPS.

Subtest	Age								Mean Loading
	16–17	18–19	25–34	45–54	60–64	65–69	70–74	75+	
Verbal Subtests :									
Information	37	31	31	30	41	37	42	43	37
Comprehension	29	33	24	25	29	35	39	37	31
Arithmetic	22	26	20	14	22	19	33	45	25
Similarities	22	31	29	22	26	18	28	11	23
Digit Span	14	26	18	09	03	26	26	40	20
Vocabulary	33	39	37	36	34	37	40	55	39
Mean Loading-Verbal	26	31	26	23	26	29	35	38	29
Performance Subtests :									
Digit Symbol	09	22	11	10	—01	05	04	21	10
Picture Completion	06	01	04	05	19	11	27	03	10
Block Design	—04	—10	—09	—15	—08	—21	—29	04	—11
Picture Arrangement	02	01	07	09	06	15	08	—18	04
Object Assembly . .	—19	—13	—20	—13	—07	—22	—09	—13	—15
Mean Loading-Performance	—01	00	—02	—01	—02	—02	00	00	—01
Mean Loading-All Subtests	14	17	14	12	15	15	19	21	16

NOTE—Decimal points are omitted.

A noteworthy age trend was evident with respect to v : ed. The v : ed-factor was weakest for the 45–54 age group but showed a consistent tendency to grow stronger with increasing age. The mean verbal subtest loading on the v : ed-factor increased consistently from ·23 at 45-54 to ·38 at 75+. The magnitude of this increase was not by itself so impressive as the consistency of the increase across all five age groups. Furthermore, the increase in v : ed occurred during precisely the same age period when g grew weaker.

Examination of the subtests defining the factor summarised in Table 3 enabled one to equate it with the spatial-mechanical-practical (k : m) factor long familiar to British factor analysts. As with v : ed, the k : m-factor is a major group factor which tends to subdivide when a broad range of assessors are administered to a homogeneous sample of older subjects. Examination of the tasks comprising the WAIS subtests suggests a preponderance of k over the aspects of k : m, i.e., practical, mechanical, or physical. This hypothesis is congruent with Vernon's (1950) observation that non-verbal tests of g usually show a small spatial-perceptual component.

TABLE 3

WAIS SUBTEST LOADING ON K : M-FACTOR ACROSS AGE GROUPS.

Subtest	Age								Mean Loading
	16–17	18–19	25–34	45–54	60–64	65–69	70–74	75+	
Verbal:									
Information	–07	09	02	–04	–08	00	01	04	00
Comprehension	–01	01	04	–01	–01	–06	–02	05	00
Arithmetic	05	06	06	09	08	12	08	–02	07
Similarities	06	07	00	01	03	11	12	29	09
Digit Span	09	03	03	10	19	–02	09	–06	06
Vocabulary	–03	00	–04	–10	–02	00	06	–11	–03
Mean Loading-Verbal	01	04	02	01	03	02	06	03	03
Performance:									
Digit Symbol	12	10	14	12	31	27	37	21	20
Picture Completion	21	34	24	19	09	18	15	34	22
Block Design	32	45	37	37	40	51	64	36	43
Picture Arrangement	24	31	21	13	23	17	26	48	25
Object Assembly	40	45	43	34	34	47	38	51	42
Mean Loading-Performance	26	33	28	23	27	32	36	38	30
Mean Loading-All Subtests	13	17	14	11	14	16	19	19	16

NOTE—Decimal points are omitted.

The Block Design and Object Assembly subtests provided the best measures of k : m at all age levels except 75+ where Picture Arrangement became more important. The Digit Symbol, Picture Completion, and Picture Arrangement subtests showed slight and somewhat erratic loading on the k : m factor. Consequently, the Block Design and Object Assembly subtests should probably be used to obtain an estimate of k : m at any age except 75+. Here the sum of all performance subtests except Digit Symbol might be employed to obtain a quick estimate of k : m.

An age trend similar to that obtained for v : ed was also evident for k : m. The k : m factor was weakest for the 45-54 age group but consistently grew stronger with increasing age. The mean performance subtest loading on the k : m-factor increased from ·23 at 45–54 to ·38 at 75+.

Partition of Subtest Variance.

The Wherry-Wherry (1969) computer solution maintains orthogonality among factors at all hierarchical levels. Consequently the proportion of subtest variance accounted for by factors at all levels is obtainable directly from the hierarchical factor structure. The proportion of subtest variance accounted for by any factor is the square of the subtest loading on that factor. The proportion of subtest variance accounted for by all factors is the common variance or communality (h^2) which is the sum of the squared subtest loadings across all factors. Error variance (e) is determined by subtracting subtest reliability from unity. Specificity (s) is obtained by subtracting communality from reliability. Specificity indicates the proportion of subtest variance which reflects something different than the remaining subtests.

The absence of satisfactory reliability estimates made a complete variance partition impossible for all age groups except 18–19, 25–34 and 45–54. Only the common variance (h^2) could be partitioned among factors for the remaining age groups.

Data summarised in Table 4 shows the proportion of total WAIS subtest variance accounted for by the three factors described above. The g-factor accounted for 49 per cent of the total subtest variance across the eight age groups while the two major group factors accounted for 11 per cent of the total subtest variance. The v : ed-factor accounted for 6 per cent of the variance and the k : m-factor accounted for the remaining 5 per cent. Thus, the three factors obtained in the present study explained approximately 60 per cent of the total WAIS subtest variance across all age groups.

TABLE 4

PARTITION OF TOTAL WAIS SUBTEST VARIANCE BY SOURCE FOR EIGHT AGE GROUPS

Age Group	Source					
	g	v : ed	k : m	(h^2)	s	e
16–17	51	05	05	59	—	—
18–19	52	06	06	63	18	19
25–34	51	05	04	59	21	20
45–54	56	04	03	63	20	18
60–64	52	05	04	61	—	—
65–69	49	06	06	61	—	—
70–74	44	08	07	59	—	—
75+	40	10	08	58	—	—
Mean	(49)	(06)	(05)	(60)	—	—

NOTE—Decimal points are omitted.

The data summarised in Table 4 suggested some developmental hypotheses concerning changes in cognitive structure from the mid-50's through advanced old age. While the basic ability structure remained essentially the same as that for adolescents—a general factor and two major group factors—systematic changes appeared to occur among the basic dimensions within the ability hierarchy. However, as noted by Vernon (1950, p. 27), fluctuations in factor loadings across successive age groups may occur because of unequal variances within the respective age groups. To guard against this possibility a Friedman (1937) χ^2r was computed on rank-orderings of WAIS subtest standard deviations reported by Doppelt and Wallace (1955, pp. 318-319) for the 60–64, 65–69, 70–74 and 75+ age groups. The standard deviations reported for males and females on each subtest were ranked jointly at each age level for purposes of the analysis. A χ^2_r of 2·33 was obtained which with 3 df showed a $P = \cdot 50$. According to the results of this analysis the changes in factor loadings from age 60 through 75+ cannot be attributed to unequal variance within the four advanced age groups. This point is further illustrated by the mean subtest standard deviations across age groups which were as follows: 60–64, 2·84 ; 65-69, 2·84 ; 70–74, 2·73 ; and 75+, 2·76.

Further examination of systematic changes in factor loadings across age groups was justified since these changes were not attributable to variability in subgroup heterogeneity. First, the proportion of subtest variance attributable to g showed a gradual but consistent decrease with increasing age. At ages 45–54 the proportion of subtest variance attributable to g reached ·56 and subsequently showed a steady decrease until it dropped to only ·40 at age 75+. This decrease in g-variance may be interpreted differentially depending upon the theoretical preferences of the reader. For example, if one chooses to think of g-variance in terms of the extent of overlap among group factors then the decrease in g-variance with age would be interpreted as greater independence between the two group factors. One might, on the other hand, choose to interpret the decrease in g-variance as an actual decline in g which would be congruent with Thomson's (1951) theory of bonds. Second, the two major group factors became increasingly important with advanced age. The proportion of subtest variance attributable to v : ed increased from ·04 at ages 45–54 to ·10 at 75+ while that attributable to k : m increased from ·03 to ·08 across the same age span. These data strongly suggested that beyond the mid-50's older persons make increasing use of the most discrete sub-general abilities and correspondingly less use of general intelligence.

Subtest specificity and error variance was estimated for the 18–19, 25–34 and 45–54 age groups. For these age groups approximately one-fifth of the total variance was subtest specific. Error also accounted for about one-fifth of the total subtest variance.

The results of the Wherry-Wherry (1969) hierarchical solution provide a parsimonious explanation of WAIS subtest intercorrelations which can be interpreted meaningfully in terms of hierarchical theory. Yet, there is no reason to insist that the present hierarchical solution is more useful than Cohen's (1959) oblique solution since both provide an adequate explanation of subtest intercorrelations. From a clinical perspective the present solution should be regarded as an alternative to Cohen's (1959) conceptual framework for interpreting WAIS scores. Advantages can be cited for either solution. In some cases clinicians might find the oblique factors of greater value than the hierarchical factors since a solution with more factors should provide for increased precision in differential diagnosis. In other cases clinicians might prefer the hierarchical factors rather than the oblique factors since a solution with fewer factors necessarily provides more reliable factor scores which might reasonably be expected to possess greater stability across similar groups.

Theoretically speaking, the hierarchical solution of the present study does seem to possess some advantage over the oblique solution obtained by Cohen (1959). This advantage can be illustrated by examining communality estimates provided by the two solutions for the three age groups where direct comparison was possible, i.e., 18–19, 25–34 and 45–54. For these age groups

Cohen's (1959, p. 290) average communality for a 5-factor solution was ·671, whereas the average communality for the present v : ed—k : m solution was ·618. Thus, Cohen (1957b) was able to account for 5·3 per cent more variance by extracting three additional factors.

SUMMARY AND CONCLUSIONS.

(1) A Wherry-Wherry (1969) hierarchical factor analysis was performed on the WAIS subtest intercorrelations reported by Wechsler (1955, 1958) and Doppelt and Wallace (1955). A hierarchical arrangement of factors was clearly demonstrated. The hierarchy consisted of a strong g-factor and two subgeneral factors. The verbal subtests defined a factor equivalent to v : ed and the performance subtests defined a factor corresponding to k : m.

(2) The factor structure obtained for the WAIS at all eight age levels was highly congruent with Vernon's (1950) hierarchical ability paradigm. This generalisation was not only true with respect to the three factors indicated by the paradigm but also applied to the relative importance of factors within the ability hierarchy. The g-factor accounted for 49 per cent of the total subtest variance for the eight age groups while the two group factors together accounted for only 11 per cent of the total subtest variance.

(3) The high proportion of WAIS subtest variance attributable to g at all age levels provided strong support for the construct validity of the WAIS as an assessor of g. The verbal subtests were superior to the performance subtests as measures of g. However, all subtests provided relatively good estimates of g but Vocabulary and Information were consistently best at all age levels.

(4) Some support can be deduced for Wechsler's decision to maintain separate verbal and performance IQs if the results of the present study are considered in clinical perspective. The proportion of subtest variance attributable to v : ed and k : m cannot by itself be used to justify separate scores. However, the consistency with which these factors occur across age levels does establish the existence of different cognitive processes in the verbal and performance subtests. The clinician should find that these basic ability dimensions provide a helpful framework for interpreting the test performance of atypical subjects. For example, a wide discrepancy between verbal and performance scores would suggest a distortion of ability structure with the full scale IQ providing a questionable estimate of g.

(5) Some consistent developmental trends were evident in the hierarchical factor structure for the eight age groups. First, g-variance showed a slight but consistent tendency to decrease from the mid-50's through advanced old age. Second, the decrease in g-variance was accompanied by a corresponding increase in variance attributable to the two major group factors.

(6) The authors take the position that the results of factor analytic research with normal subjects does not necessarily provide a satisfactory framework for interpreting the test performance of atypical subjects referred for psychological evaluation. Rather, the factor structure obtained for normal subjects should be used as base line data for determining any cognitive anomalies which might characterise carefully defined pathological syndromes.

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SCOTTISH SCIENCE TEACHERS' PERCEPTIONS OF EFFECTIVE SCIENCE TEACHING

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SUMMARY. 157 science teachers from 39 schools in Scotland completed a 44-item questionnaire on their perceptions of effective science teaching. An earlier study using a 106-item questionnaire isolated eight factors which, it was suggested, were characteristic of styles of effective teaching among science teachers in England. The 44-item version consisted of those items which, in the English study, had high loadings on the eight factors. There was a high correlation between the mean ratings given to individual items by the Scots and the English, though the English teachers placed greater emphasis on 'pupil-centredness.' However, none of the eight factors identified in the English study appeared in the factor analysis of the Scottish responses. The greater centralisation of education in Scotland may account for the lack of validity of the scale in the Scottish context, but doubt must be cast on the generality of the factor structure of the scale.

INTRODUCTION

ASSESSMENTS of teachers' attitudes towards teaching or teachers' own conceptions of good teaching have been widely used in the study of teaching competence and in efforts to identify 'effective teachers.' The most popular instrument in this area has been the Minnesota Teacher Attitude Inventory (MTAI: Cook *et al.*, 1951). The construction and validation of this scale did not derive from a theoretical model but was empirically developed using the researchers' preconceived criteria of what constitutes 'good teaching.'

Other instruments, more relevant to education in Britain, such as the Manchester Scales of Opinions about Education (Oliver and Butcher, 1962), and the Role Definition Instrument (Finlayson and Cohen, 1967), are useful in the comparison of the attitudes of different groups of teachers or student teachers (Butcher, 1965; Finlayson and Cohen, 1967; McIntyre and Morrison, 1967; Oliver and Butcher, 1968) but do not appear to carry clear implications for the teacher's classroom behaviour.

There is evidence (for example, McLean *et al.*, 1955) using the Study of Values (Allport *et al.*, 1951) that teachers' ideas about teaching are strongly influenced by the subject which they are teaching. Getzels and Jackson (1963) point out that the use of other instruments such as the Kuder Preference Record (Kuder, 1953) and the Strong Vocational Interest Blank (Strong, 1943) would not be very profitable in studying 'good 'teachers *versus* 'poor' teachers unless the teachers were subdivided into subject matter areas. They point to the dangers of assuming a unitary nature for teachers' attitudes to teaching across subjects and teaching levels.

In order to assess attitudes or ideologies which might allow prediction of the teacher's classroom behaviour it would seem desirable to construct instruments that fulfil the following conditions:

(*a*) they should be based on *teachers'* constructs of 'good teaching' (unlike MTAI);

(*b*) they should be directly related to classroom teaching (unlike the Manchester Scales);

(*c*) they should take account of subject area.

Taylor *et al.* (1970) have attempted to construct such an instrument in the area of science teaching. Initially they maintained two concurrent activities: the development of a conceptual framework or sub-theory, and discussions with experienced science teachers of what constituted teaching effectiveness. These teachers produced some 300 statements relating to their perceptions of effective science teaching. The theoretical model on which the study was based has three basic dimensions:

A. the teacher's classroom behaviour and relationships;
B. the teacher's preparatory behaviour including his relationships with his colleagues and with pupils in general outside the classroom and laboratory;
C. the standing conditions or requirements of teaching including the teacher's professional qualifications in his subject and in the study of education, and his desire to pursue these further.

These areas are further sub-divided. 'A' covers classroom and laboratory organisation; the act of teaching; discipline and control; and evaluating. 'B' covers lesson planning and preparation; activities and relationships within the school and outwith the school; and co-operation with other teachers. 'C' covers qualifications and training; attitudes, values and interests; and competence and professionalism.

The authors found that they were able to allocate 106 of the 300 statements to the 13 subdivisions of the model without apparent ambiguity, duplication or undue complexity. These 106 items were placed in random order and administered as a "Questionnaire Rating Effective Science Teaching" to 58 science teachers in England.

Factor analysis of the responses to the questionnaire suggested eight second-order factors isolated as perceived characteristics of styles of effective science teaching, about 45 of the original 106 items having sufficiently high loadings on the factors to be used in defining the eight styles. The authors suggest that these, together with additional items defining the eight scales could be used to construct a "Perceptions of Effective Science Teaching" scale. The interpretations put by the authors on each of their eight factors are not immediately obvious on inspection of items loading highly on these factors. This is perhaps reflected in the rather vague (though plausible) names given to some factors:

(1) 'Face-to-face science teaching.'
(2) 'Face-to-science science teaching.'
(3) 'Impersonal, evaluative (pens out, facts down) science teaching.'
(4) 'Pupil autonomy science teaching.'
(5) 'Classroom management science teaching.'
(6) 'Competent science teaching.'
(7) 'Laboratory-assistant or production-line science teaching.'
(8) 'Science subject matter teaching.'

This instrument appeared to be appropriate for a study, now in progress in Scotland, that is concerned with how the changes in pupils' attitudes to science are related to differences among science teachers. Direct observation of teachers' classroom behaviour would have been used for evaluation of the 'teacher effect' but limited resources made this impracticable in the study that involves more than 150 teachers in 39 schools all over Scotland.

However, before use could be made of the scales developed by Taylor *et al.*, there was a need to replicate their work in order (*a*) to test the items in the Scottish context ; (*b*) to test a larger sample ; (*c*) to test the generality of the factor structure. Inspection of the items loading heavily on the factors isolated in the English study suggested that they would all be relevant to science teaching in Scotland. Accordingly, these items were extracted from the original 106-item questionnaire and used to investigate perceptions of effective science teaching among Scottish science teachers.

METHODOLOGY AND RESEARCH DESIGN

A questionnaire of 44 items, distributed at random, was drawn up.* This consisted of those items of the 106-item scale described above with the highest loadings on each of the eight factors. Each factor was described by at least four items and only one of the factors was bipolar. The distribution of items among the three basic dimensions of the model for those items selected for the 44-item scale was not significantly different ($\chi^2=1{\cdot}8911$; df=2) from that of those items NOT selected for the scale. The questionnaire was completed by 157 science teachers all of whom were involved in first and second year secondary school science teaching. The sample had a mean teaching experience of eight years and 42 per cent had less than five years' teaching experience. They came from a sample of 39 schools from all over Scotland, the schools being stratified by size, denomination, location and type of science course offered. The items were rated on a five-point scale, 5 signifying that the item was considered ' extremely important ' and 1 signifying that the item was ' not relevant in science teaching.'

STATISTICAL ANALYSIS

Since this is an exploratory study of science teachers in Scotland factor analysis appeared as an appropriate technique, and in order to make comparisons with the earlier study the procedure of Taylor *et al.* was followed as closely as possible. The mean value and standard deviation for the Scottish teachers' scores for each of the 44 items was calculated. A Pearson product-moment correlation was used to investigate the relationship between these 44 mean scores with the mean scores of the English teachers on the same items. ' t ' tests were applied to the differences between the Scottish and English means on each item.

Correlations between item scores for Scottish teachers were computed and factor analyses at the first and second-order level were carried out using STATPACK, a program developed at the Computer Unit, University of Warwick, from the Hallworth and Brebner package for multivariate analysis (Hallworth and Brebner, 1965). This program provides principal components from the inter-variable correlation matrix, a rotation to the varimax criterion, transformation of the varimax factors to promax oblique factors, and second-order factors (principal components followed by varimax). The factor analysis was carried out on raw scores for the teachers' responses to the 44 items. The mean score and standard deviation for each teacher over the 44 items was then calculated, the standardised z-score for each teacher on each item was computed, and the factor analysis was repeated using z-scores.

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* Copies of this questionnaire may be obtained from Mrs. Sally Brown, Department of Education, University of Stirling.

RESULTS

There was a high correlation ($r = \cdot 88$) between mean scores on each item for the Scottish teachers and the English teachers. ' t '-tests for the difference between mean scores of the two samples from the same population (i.e., secondary school science teachers) showed significant (above 5 per cent level) differences on 10 items. Items with significant ' t ' values are listed below :

(*a*) Rated higher by teachers in England—

5. Relates new learning to natural phenomena within experience of pupil in order to develop meaningful associations. (t 4·6 ; $P < \cdot 001$).
7. Encourages pupils to set themselves goals according to their abilities. (t 4·6 ; $P < \cdot 001$).
9. Affects his pupils so that they wish to take more advanced courses in science. (t 2·0 ; $P < \cdot 05$).
17. Can help pupils differentiate between hypotheses, facts, superstition and theory as well as encourage pupils to suspend judgment when faced with inadequate scientific evidence. (t 2·1 ; $P < \cdot 05$).
19. Has patience in dealing with pupils. (t 2·1 ; $P < \cdot 05$).
24. Can locate sources for free and inexpensive science teaching material. (t 2·7 ; $P < \cdot 01$).
30. Encourages pupils' to bring appropriate materials and specimens to class. (t 3·1 ; $P < \cdot 002$).
33. Helps pupils to prepare for a career in science or technology. (t 2·3 ; $P < \cdot 05$).

(*b*) Rated higher by teachers in Scotland—

36. Is confident and at ease when teaching. (t 3·4 ; $P < \cdot 001$).
37. Knows how to proceed if there is a serious problem of discipline. (t 3·8 ; $P < \cdot 001$.)

The 44 mean item scores were divided into three rating groups: ' high,' ' medium ' and ' low.' These groups were arbitrarily defined to allow the numbers of items in each group to be roughly equal. ' High ' corresponds to ratings above 4·0 (' very important '), ' medium ' to ratings between 3·5 and 4·0, and ' low ' to ratings below 3·5. There were only four items in the *Teacher's Preparatory Behaviour* category, one with ' medium rating ' and three with ' low ' rating. There was no significant difference between the distributions of items in the *Teacher's Classroom Behaviour* and *Standing Requirement of Teaching* categories over the ' high,' ' medium ' and ' low ' ratings ($\chi^2 = \cdot 1772$; $df = 2$). The corresponding value of $\chi^2 = 3 \cdot 1009$ ($df = 2$) for the 106-item scale in the English study, though considerably higher, is still not significant. If the English responses on the 44 items only are considered, an even lower value of $\chi^2 = \cdot 0592$ ($df = 2$) is obtained.

Items with ' high ' mean rating for Scottish teachers (i.e., above ' very important,' are listed below. With the exception of two items (1 and 25) they appeared in the ' high ' group of the English study.

1. Is consistently fair and emotionally calm when enforcing rules.
2. Teaches for understanding rather than reproduction of learned material.
4. Has a genuine interest in science and believes in the academic and practical use of the subject.
5. Relates new learning to natural phenomena within the experience of the pupil in order to develop meaningful associations.

12. Can devise experiments which involve pupil participation in learning.
13. Willingly consults colleagues in case of professional difficulties.
16. Tries to stimulate pupils to think for themselves about science.
19. Has patience in his dealing with pupils.
25. Is clear and unequivocal in his personal relationship with pupils.
29. Changes curriculum and methods to keep up to date with developments in his subject and methods for teaching it.
36. Is confident and at ease when teaching.
37. Knows how to proceed if there is a serious problem of discipline.
40. Develops interests in science in his pupils.
43. Is willing to change an opinion or conclusion because of later evidence.
44. Is constructive and helpful in his criticism of pupils.

Of the items with mean scores of less than 3·0 (i.e., below 'important') listed below, two (8 and 18) were also rated below 'important' by the teachers in England.

8. Can interpret the results of diagnostic instruments used in schools (IQ, aptitude and achievement tests).
18. Uses pupils to carry out routine duties such as giving out books, cleaning the blackboard, etc.
33. Helps pupils to prepare for a career in science or technology.
38. Has studied the philosophy and psychology of education.

Since the items forming the scale were based on those whose loadings most completely defined the eight factors extracted previously, it was hoped that the first-order factor analysis might produce an appropriate group of factors. Using the Kaiser criterion, that all factors with roots greater than unity be extracted in the principal components, 12 factors emerged. It will be seen, however (Table 1) that the total variance accounted for by these twelve is 64·2 per cent of which 29·1 per cent is due to Factor 1. The latent root values of the other factors suggest they are all scree and that there is little justification for accepting more than one general factor. The inclusion of three more factors with roots just less than unity in the table supports the view that there is little reason for a cut-off at 12 factors.

TABLE 1

LATENT ROOT VALUES AND PERCENTAGE VARIANCE ACCOUNTED FOR BY FIRST-ORDER FACTORS EXTRACTED IN PRINCIPAL COMPONENTS ANALYSIS OF RAW DATA

Total variance accounted for: 64·2 per cent.

Factor number	Latent root	% variance accounted for	Factor number	Latent root	% variance accounted for
1	12·81	29·1	9	1·15	2·6
2	2·13	4·8	10	1·10	2·5
3	1·76	4·0	11	1·04	2·4
4	1·68	3·8	12	1·01	2·3
5	1·62	3·7			
6	1·43	3·2	13	0·96	2·2
7	1·37	3·1	14	0·90	2·1
8	1·18	2·7	15	0·89	2·0

TABLE 2

LATENT ROOT VALUES AND PERCENTAGE VARIANCE ACCOUNTED FOR BY FIRST-ORDER FACTORS EXTRACTED IN PRINCIPAL COMPONENTS ANALYSIS ON STANDARDISED ITEM RATINGS.

Total variance accounted for: 69·3 per cent.

Factor number	Latent root	% variance accounted for	Factor number	Latent root	% variance accounted for
1	2·66	6·1	11	1·38	3·1
2	2·46	5·6	12	1·33	3·0
3	2·38	5·4	13	1·30	3·0
4	2·04	4·6	14	1·26	2·9
5	1·94	4·4	15	1·22	2·8
6	1·76	4·0	16	1·15	2·6
7	1·71	3·9	17	1·11	2·5
8	1·65	3·8	18	1·06	2·4
9	1·56	3·6	19	1·01	2·3
10	1·44	3·3			

However, for interest the first-order varimax and promax solutions were computed and followed by a second-order principal components and varimax. The second-order analysis identified three factors accounting for 54·8 per cent of the variance. When the loadings for each item were examined no relationship between the factors emerging from Taylor's study and either our first- or second-order factors could be seen.

The dominant general factor in the first-order principal components analysis had a positive loading above ·45 for 40 out of the 44 variables making item discrimination difficult. This suggested that the factor might be accounted for by the response sets of individual teachers (i.e., one teacher might take 3—' important ' as a mean position while another might take 4—' very important ' as a mean position; similarly the range of ratings will vary between individual teachers). This would lead to positive correlations between scores on any pair of items. The data showed that out of 946 such correlations 940 were, indeed, positive.

To avoid this problem standardised z-scores were computed for each individual teacher so that each individual's distribution of ratings had the same mean and standard deviation. This made no difference to the rank order of items' mean scores and that aspect of the study remains unchanged. Correlations and factor analysis based on these z-scores were then carried out, and nineteen first-order and seven second-order bipolar factors were extracted accounting for 69·3 per cent and 61·8 per cent of the variance, respectively. Inspection of the item loadings on the second-order factors failed to identify any of them with any of Taylor's factors. However, a plausible (though as with the English study far from ' obvious ') interpretation of our factor structure could be made in terms of the identification of discrete styles of teaching among *Scottish* science teachers. Unfortunately, this factor structure was found to be unstable as described below.

Table 2 shows that once again there was a problem in justifying the cut-off point for the first-order factors and it was decided to compare the results of two analyses, one extracting 15 first-order factors and the other 19. It was hoped that the extraction of extra first-order factors would result in the firmer definition of second-order factors, and it was expected that more second-order factors would appear. In practice it was found that the second-order structure was greatly changed ; the number of factors differed by only one but no resemblance between the two groups could be found.

Six of the *first-order* factors were found to be stable but each was defined by only two items with high loading (> ·5). Items defining three of these factors are given below.

Factor 1.

36. Is confident and at ease when teaching.
37. Knows how to proceed if there is a serious problem of discipline.

Factor 2.

34. Can apply his knowledge of the psychology of learning to the teaching of his subject.
38. Has studied the philosophy and psychology of education.

Factor 3.

33. Helps pupils to prepare for a career in science or technology.
9. Affects his pupils so that they wish to take more advanced courses in science.

Most pairs provide a fairly straightforward factor interpretation but no pair is to be found together in one of the groups of items defining Taylor's factors.

DISCUSSION

While there is a high correlation between the English and Scottish teachers' ratings of individual items, no clear picture of emphasis on a particular category of the model of teaching effectiveness emerges from the Scottish responses to the shortened version of the scale. It would appear that items in the category of *Teacher's Preparatory Behaviour* are rated low, but there is no evidence from either Scottish or English ratings on the 44 items to support the claim that " science teachers place the greatest emphasis on the dimension of effective science teaching concerned with the teacher's classroom behaviour, and the least on the dimension concerned with the standing requirements of teaching " (Taylor *et al.*, 1970).

The two items rated higher by the Scots than the English were concerned with smooth running of the classroom. It is, perhaps, not surprising that the Scottish teachers, the majority of whom are concerned with teaching integrated science to lower secondary age-groups from the whole range of abilities in mixed ability classes, should rate such items more highly than the English teachers who were teaching separate science subjects to pupils of average or above average ability. Explicit reference to pupils in seven out of eight items scored higher by teachers in England points to a far more pupil-centred strategy than that of the Scots.

From the items rated ' high ' by the Scots there emerges an ' ideal ' picture of science teaching in Scotland where the pupils are kept under control but in an atmosphere without undue restraint ; with a teacher who presents the material in a clear and unbiased way placing emphasis on pupils' participation, understanding and interest in the work ; and where the teacher's interests in science is supported by a willingness to seek outside help and modify his opinions and teaching programme. With seven of the 15 ' high ' items referring explicitly to the pupil we might conclude that a pupil-centred approach was favoured, but this proportion is not significantly different from that of the scale as a whole, for which 21 out of 44 items refer explicitly to pupils.

Of the items rated below ' important,' two (8 and 38) perhaps indicate a lack of emphasis on the theoretical and evaluative aspects of education. Analysis has not revealed any salient factors by which Scottish science teachers could be classified in terms of variation in their perceptions of effective science teaching. Variations from the common pattern of priorities found in both England and Scotland appear to be idiosyncratic rather than to reflect differing ideologies.

It is possible that the failure to replicate the English findings is related to the more centralised pattern of education in Scotland. The fact that the examination syllabuses, secondary science curriculum development, and in-service training courses have been largely in the hands of the same group of people, may have led to a relative absence of ideological debate among Scottish science teachers and so inhibited the development of clear-cut dimensions of ideology.

However, speculation on the differences in structure of ideologies between science teachers in Scotland and England would be unwise until replication of Taylor's study has shown that the instrument can be assumed valid for application to English teachers. Regrettably, it is clearly invalid for discriminating among Scottish science teachers.

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THE FACTOR STRUCTURE OF TEACHER ATTITUDES TO SIXTH FORM EDUCATION

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SUMMARY. A 40-item, Likert-type attitude inventory was completed by a sample of 448 teachers in schools with sixth forms. The inventory comprised five scales of equal length relating to attitudes to sixth form education defined in discussion with teachers and through searches of the relevant literature. A first order factor analysis yielded eight factors, six of which are interpreted. A second order analysis is described in which two factors only are retained from the eight principal components. It is concluded that this analysis shows features similar to those discovered in studies of American teachers, and provides some confirmation for the view that attitudes towards education are basically dualistic. Implications for policy making in the area of sixth form education are briefly discussed.

INTRODUCTION

THE policies to be pursued in determining the structure of sixth form education have for a number of years been a matter of lively contention. Over the past seven years five major Schools Council working papers have been devoted to this topic (Schools Council, 1966, 1967, 1969, 1972, 1973a, 1973b) and in that same period many other bodies and individuals have published proposals for the sixth form curriculum. In the absence of any desire on the part of the Department of Education and Science to intervene decisively in the controversy, it is recognised that, to stand a serious chance of implementation, any new curricular pattern must command the support of teachers, or at least secure their acquiescence. The question of the attitudes which teachers hold towards sixth form education becomes, therefore, a matter of critical interest.

An investigation of this topic was undertaken by the present authors in 1971, and some results published which described teacher attitudes in terms of scale scores and related these to the preferences expressed by teachers for a number of possible schemes for organising the curriculum of the sixth form (Taylor, Reid and Holley, in press). Further explorations of the data have now been carried out, using a factor analytic approach, and it is upon these that the present paper is based.

THE ATTITUDE TEST AND THE SAMPLE

A Likert-type attitude test comprising 40 items was completed by 448 teachers in 30 schools with sixth forms in the West Midlands and North-West. The schools were a sub-sample of a larger sample, the characteristics of which have been described in detail elsewhere (Reid, 1972), and were, on criteria such as size, organisation and selectivity, representative of schools with sixth forms in their area. Table 1 sets out some of the characteristics of the respondents.

TABLE 1

CHARACTERISTICS OF TEACHER SAMPLE (N=448)

Sex	Men	259
	Women	189
A-level subjects taught	Mathematics or Science	134
	Arts or Social Sciences	161
	General Studies	51
	Other (Arts, Crafts, R.E., Music, etc.)	50
	No A-level	52
Time spent with sixth form	None	53
	Up to 50%	363
	Up to 75%	32
Source of first degrees	Oxford/Cambridge	52
	London	52
	Older Civic	106
	Newer Civic	32
	Wales	32
	Other	42
	No degree	132
Type of school	Grammar	229
	Comprehensive	153
	Technical	10
	Direct Grant	56
Status in school	Head of Department	178
	Assistant (Graded post)	107
	Assistant	153
	Other	10

The initial pool of items for the attitude test had been developed in discussion with teachers and through a study of the literature on sixth form education, such as the Crowther Report (Central Advisory Council for Education (England), 1959-60) and on the characteristics of traditionalists and innovators (especially Gardiner, 1963). As a result of this preliminary work four major dimensions of teacher attitude towards sixth form education were identified. They are briefly described below.

Attitude to Innovation.

Readiness to depart from established practices. Examples of items: " However the curriculum is organised, the underlying aims of sixth form education will always remain the same," or " The status of sixth form teachers should reflect the academic qualifications which they possess." (*I-Scale.*)

Attitude to Specialisation.

Support for a curriculum closely tied to the study of two or three academic subjects drawn from similar fields. Examples of items: " Far from being restrictive, specialisation at sixth form level is an agent of intellectual liberation," or " We are suffering today from too much academic specialisation. The country needs a better supply of able generalists." (*S-Scale.*)

Attitude to Openness.

The extent to which the sixth form should be open to extraneous influences. Examples of items : " Entry to a sixth form should always be dependent upon the attainment of a specified standard at O-level," or " The demands of sixth form education should be adjusted to meet the requirements of a broader ability range." (*O-Scale.*)

Attitude to Elitism.

The association of sixth form education with specially talented students who are to be marked off from those of lesser ability. Examples of items : " We must always preserve the distinction between academic and non-academic pupils ; between university education and other higher education," or " The major duty of the sixth form teacher is towards the pupils who have the capacity to benefit from a university education." (*E-Scale.*)

A pilot survey of 83 teachers and students was carried out to provide data for item analysis, as a result of which a final test of 32 items, eight drawn from each scale was prepared. At the same time the results of other research (Reid, 1972) had indicated the advisability of including a further scale to investigate attitudes to the study of Arts or Sciences. Thus the final version of the test included five scales totalling 40 items. The Arts/Science scale may be described as follows :

Attitude to Arts and Sciences.

Attitude to the relative merits of Arts and Science subjects as components of a sixth form curriculum. Examples of items : " The arts sixth former is more likely than the science student to show an understanding of human problems," or " For really outstanding pupils, the sciences can provide a sterner challenge than the arts." (*A/S-Scale.*)

Analysis of the results of the survey completed by 448 teachers indicated that, although 39 of the 40 items had secured higher correlations with their own scales than with any of the others, only 11 of the correlations exceeded 0·60, and that substantial correlations existed between the scales (shown in Table 2).

TABLE 2

Correlations Between Attitude Scales (N=448).

Scale	Mean	SD	I	S	O	E	A/S
I	25·20	4·61	—	–0·46	0·42	–0·58	0·06
S	22·17	4·52	—	—	–0·31	0·38	–0·10
O	23·33	4·48	—	—	—	–0·42	–0·04
E	26·34	5·07	—	—	—	—	–0·04
A/S	22·94	4·33	—	—	—	—	—

It seemed, therefore, that it would be useful to investigate the intercorrelations of all the individual items by factor analysis.

FIRST ORDER FACTOR ANALYSIS

A first order factor analysis (principal components rotated to varimax criterion) produced 11 factors with eigen values greater than unity. Of these, the last four factors were either highly specific, or difficult to interpret, and a scree test confirmed that it was probably better to confine the analysis to eight factors only. The analysis was, therefore, repeated with an earlier cut-off, yielding the following factors:

Factor I (9·3 *per cent of variance*).

	Item	Scale	Loading†
28.	Aims remain the same*	I	0·63
33.	Fears about specialisation unfounded	S	0·62
27.	Ability to meet entry requirement	I	0·59
26.	O-level Latin requirement	E	0·57
40.	Specialist teachers and able pupils	I	0·56
32.	Status of teachers	I	0·54

Most of the items are from the Innovation scale, and where they are drawn from other scales, they still reflect Gardiner's characterisation of negative attitudes to change, and are particularly concerned with rules and precedents. This is, therefore, identified as an *Anti-Innovation Factor.*

Factor II (10·5 *per cent*).

	Item	Scale	Loading
29.	Adjustment to a broader ability range	O	–0·74
25.	Open to all over the age of 16	O	–0·65
39.	Elitist attitudes outmoded	E	–0·63
9.	Time for reappraisal of aims	I	–0·60
20.	Sixth form and whole age group	O	–0·52
1.	Entry should depend on O-level	O	+0·58

The Openness scale provides most of the items which have high loadings on this factor, but only one type of item is represented: that which refers to the opening up of sixth forms to non-traditional pupils, and to the treatment of sixth formers in ways which do not mark them off as being different from other members of their age group. (The E-scale item fits well here.) Associated with these O-scale items is the item from the I-scale, " The time has come for a thorough reappraisal of the aims of sixth form education." It would appear, therefore, that this factor associates a desire to innovate with a notion of the sixth form as a ' comprehensive ' educational institution. The factor is considered to be a *Pro-Innovation Openness Factor.*

Factor III (4·8 *per cent*).

	Item	Scale	Loading
22.	Science provides a sterner challenge	A/S	0·69
34.	Science aids correct inference from evidence	A/S	0·55
16.	Deficient science background a handicap	A/S	0·50
13.	Science not an aid to logical thinking	A/S	–0·57

This factor associates all the items in the Arts/Science scale having a special reference to science. It can be called an *Attitude to Scientific Studies Factor.*

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* Abbreviated wording. For full form of items, see Appendix.

† All loadings of 0·5 or greater, except where an item has its highest loading on another factor Two negative loadings on factor IV are included which do not reach the 0·5 level.

Factor IV (5·6 *per cent*).

	Item	Scale	Loading
14.	Specialisation as intellectual liberation	S	0·68
8.	Pupils are eager to specialise	S	0·63
18.	Subject-mindedness is there	S	0·52
38.	Delayed commitment to specialisms	S	–0·46
31.	The country needs more generalists	S	–0·44

This is clearly a *Specialisation Factor.*

Factor V (4·9 *per cent*).

	Item	Scale	Loading
30.	Community has a right to control the curriculum	O	0·74
15.	Parents have right to influence what is taught	O	0·96
21.	Sixth form not subject to social pressures	O	–0·63

This factor brings together O-scale items which refer to the openness of sixth form education to social forces (cf. Factor II). It is a *Community Influences Factor.*

Factor VI (4·0 *per cent*).
This factor accounts for little variance and is not interpretable.

Factor VII (5·0 *per cent*).

	Item	Scale	Loading
3.	Arts and understanding human problems	A/S	0·77
24.	Arts students have less need of broader education	A/S	0·62
7.	Abandonment of arts and clear expression	A/S	0·60

With one exception, items on the A/S scale having a specific reference to arts are picked out by this factor, which can be described as *Attitude to Humanistic Studies* (cf. Factor III).

Factor VIII (4·0 *per cent*).
Like factor VI this factor picks up little variance and is difficult to interpret.

DISCUSSION

To a very large extent, the *a priori* scales are reflected in the first order factor analysis, but with some important refinements. First of all, conceptualising attitude to innovation as undimensional is seen to be simplistic. The results of the factor analysis tend rather to support Kerlinger's contention (1967, p. 193) that " social attitudes, of which educational attitudes are a part, are dualistic," and that, according to the position an individual supports, one of two different sets of issues and problems give rise to the criteria by which he judges actions or proposals for action. Or, to use Kerlinger's own terminology, different ' referents ' can be ' criterial ' for different individuals. Innovators, he suggests, are sensitive to different issues and problems, or to different aspects of them, from those which focus the concerns of conservatives. An alternative hypothesis, and one which would seem to be widely held by educational policy makers, is that attitudes are fundamentally unidimensional and bipolar; so that the basic principle in consensus building is taken to be the discovery of an appropriate point on a continuum connecting policies pleasing to innovators with those pleasing to conservatives, or on the dimension joining any other pair of groups holding apparently opposite views or allegiances. But just as the results reported here cast doubt on the validity of assuming an innovative-conservative dimension, so they also seem to indicate that teacher attitudes towards scientific and humanistic studies are not bipolar. This clearly has implications for the attitudes which may be held by sixth formers themselves, and indicates that caution must be used in extrapolating from empirical studies of knowledge (Richmond, 1963), or abilities (Hudson, 1966) to the preferences and values which may characterise students.

From the point of view of policy making for sixth form education, the issue of whether fundamental attitudes to education are, or are not dualistic is an important one. Any proposal for change must try to achieve general aims by addressing itself to specific areas of decision. Should students study more or fewer subjects? Should they take more or fewer examinations? How should questions of who follows what curriculum and where be decided? But if some decision areas are criterial for innovators and others for conservatives, the question of which ones play a central role in any set of proposals must be a matter of very careful consideration. One may speculate that the Q and F proposals (Schools Council, 1969), while providing grounds for the opposition of conservatives (less specialisation, suggestions for restrictions on choice of subjects) also failed to provide anything to which innovators could respond (less academic syllabuses? fewer examinations?).

However, Kerlinger's contention is not simply that a given attitude towards education is likely to turn out to be dualistic, but that educational attitudes *as a whole* consist of two relatively independent basic dimensions[*] which may be briefly described as ' progressive ' and ' conservative,' and that these " may emerge in first-order factor analysis, but . . . are more likely to emerge in second-order factor analysis . . . " (loc. cit.). Analysis of the data from the sixth form teachers was therefore carried to the second-order level to see if this expectation, which had been fulfilled in investigations of three American samples of similar size (N=344, 404, 556), was also realised for the English sample. In order to test Kerlinger's hypothesis, only two factors were retained from the second-order principal components analysis for rotation to the varimax criterion. Table 3 sets out loadings greater than 0·4 on these two factors. In each case loadings on the alternate factor are quoted for comparison.

Factor A accounts for 22·1 per cent of variance, and Factor B 21·3 per cent so that the total variance associated with the two second-order factors (43·4 per cent) is a very substantial proportion of that represented by the eight initial factors. The variable loadings seem to bear out Kerlinger's hypothesis. Major loadings on Factor A pull together a variety of traditional features of sixth form education—specialist teachers working with able pupils, the 'university bound' marked off from the rest—and couple them with a belief in the immutability of aims and with an inability to visualise alternatives. Factor B, on the other hand, while exhibiting some negative loadings on items of this type, has its positive pole defined by the need to delay specialisation, produce more generalists and adjust to a broader ability range. In this case associated loadings are found on the desirability of reappraising aims, and the declaration that elitist attitudes are outmoded. It seems that the attitudes of sixth form teachers, just as those of the teachers in Kerlinger's samples, may be fundamentally dualistic in character.

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[*] Earlier research by Kerlinger (Kerlinger and Kaya, 1959) gave rise to similar conclusions which were criticised by Oliver and Butcher (1962) on the grounds that the scales contained items phrased in only one direction (e g., no anti-progressive items in the progressivism scale). However, Kerlinger (1967, p. 191) implies that such objections have been met in the later work. In any case it is interesting to note that Oliver and Butcher themselves found two major factors in their first order analysis (16·8 per cent and 10·3 per cent of variance before rotation, against 6·1 per cent and 4·5 per cent for the third and fourth factors), and were forced to conclude that " It seems as if the descriptions of attitudes arrived at by psychological research fitted teachers' opinions about education better than that which is usually employed in accounts of philosophies of education " (1962, p. 68) For a comparable analysis in another field, see Eysenck's (1954) description of political attitudes in two basic dimensions (Tender-minded/tough-minded, Radical/Conservative).

TABLE 3

LOADINGS ON SECOND-ORDER FACTORS.

Item	Scale	Factor A	Factor B
2. Success of students measured by degrees in specialism	E	*0·48*	*—0·42*
4 Maintaining traditional standards	E	*0·45*	—0·37
6. Bias of interest short-lived	S	0·18	*0·48*
9. Time for reappraisal of aims	I	—0·15	*0·47*
11. Good teacher can handle any topic	I	0·21	*0·41*
12. Distinction between academic and non-academic	E	*0·53*	—0·34
14. Specialisation as intellectual liberation	S	0·28	*—0·45*
17. Not possible to envisage different organisation	I	*0·41*	—0·08
20. Sixth form and whole age group	O	—0·12	*0·43*
22. Science provides a sterner challenge	A/S	*0·41*	—0·03
23. Major duty to university entrant	E	*0·61*	—0·23
24. Arts students have less need of broader education	A/S	*0·42*	0·19
26. O-level Latin requirement	E	*0·43*	—0·07
27. Ability to meet entry requirement	I	*0·53*	—0·19
28. Aims remain the same	I	*0·42*	0·00
29. Adjustment to a broader ability range	O	—0·15	*0·48*
31. The country needs more generalists	S	0·16	*0·70*
32. Status of teachers	I	*0·46*	—0·23
34. Science aids correct inference from evidence	A/S	*0·56*	0·03
35. Risky to make judgments about potential	S	—0·01	*0·50*
38. Delayed commitment to specialisms	S	0·18	*0·66*
39. Elitist attitudes outmoded	E	—0·04	*0·48*
40. Specialist teachers and able pupils	I	*0·58*	—0·08

The results of the second order analysis serve, therefore, to reinforce the point already made, that a consensus among teachers about the desirability of specific changes in the sixth form curriculum can only be brought about if policy makers become more sensitive to the fundamental characteristics of teacher attitudes.

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APPENDIX

LIST OF ITEM WORDINGS

1. Entry to a sixth form should always depend upon the attainment of a specified standard at O-level.
2. The success of sixth form and higher education is best measured by the number of students who gain honours degrees in their specialisms.
3. The arts sixth former is more likely than the science student to show an understanding of human problems.
4. At the present time the universities need all the help they can get in maintaining traditional standards.
5. Sixth form teachers should always have the opportunity of taking junior classes so that they can spot promising pupils and give them encouragement.
6. The bias of interest shown by pupils on entering the sixth form is quite likely to be short-lived.
7. Sixth formers who have discontinued the study of arts subjects often find difficulty in expressing themselves clearly in writing.
8. Pupils who are ' university material ' are eager to specialise after O-levels.
9. The time has come for a thorough reappraisal of the aims of sixth form education.
10. In arts subjects it is often possible to make up for a lack of real understanding with a ready flow of words.
11. A good sixth form teacher is one who can turn his hand to any topic which the curriculum demands.

12. We must always preserve the distinction between academic and non-academic pupils ; between university education and other higher education.
13. A training in science subjects does not necessarily improve a pupil's general capacity for logical thinking.
14. Far from being restrictive, specialisation at sixth form level is an agent of intellectual liberation.
15. Parents and employers have a right to influence what is taught in sixth forms.
16. A deficient scientific background is more of a handicap than a lack of acquaintance with the arts.
17. It is not really possible to envisage any method of organising the sixth form curriculum which could differ significantly from present practice.
18. Subject-mindedness is there whether we use it or not.
19. The major problem facing sixth form teachers today is that of the pupil of poor academic quality.
20. The problems of educating sixth formers cannot be separated from the problems of the whole age group, both within and without the educational system.
21. A sixth form education must be a liberal education and, as such, must not be subject to social or economic pressures.
22. For really outstanding pupils, the sciences can provide a sterner challenge than the arts.
23. The major duty of the sixth form teacher is towards the pupil who has the capacity to benefit from a university education.
24. A broader education is a far more urgent necessity for science students than for arts students.
25. Sixth form education should be open to all who wish to remain at school after the age of 16.
26. It will be very difficult to maintain standards if university departments drop traditional requirements such as O-level Latin.
27. Ability to meet the entry requirement is the best indication of suitability for a degree course.
28. However the curriculum is organised, the underlying aims of sixth form education will always remain the same.
29. The demands of sixth form education should be adjusted to meet the requirements of a broader ability range.
30. Our economy is so dependent upon educated manpower that the community must have the right to exercise a measure of control over the curriculum of the sixth form.
31. We are suffering today from too much academic specialisation. The country needs a better supply of able generalists.
32. The status of sixth form teachers should reflect the academic qualifications which they possess.
33. Fears about the adverse effects of early specialisation are, for the most part, unfounded.
34. The choice of sciences in the sixth form affords the best opportunity for developing an ability to draw correct inferences from evidence.
35. Making judgments about pupils' academic potential can be a risky business, even when they are in the sixth form.
36. Sixth formers cannot acquire the qualities needed for success in a university course unless they have the opportunity to enjoy a close relationship with their teachers.
37. There are no enduring aims in sixth form education : they vary according to the social and economic needs of the community.
38. One of the greatest needs in sixth form and university education today is to ensure that commitment to specialisms takes place as late as possible.
39. Elitist attitudes to sixth form education are completely outmoded.
40. All true sixth form education rests on the partnership of specialist teachers and able pupils.

RESEARCH NOTES

EXTRAVERSION, NEUROTICISM AND ACADEMIC ATTAINMENT IN UGANDA

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SUMMARY. This study examines a neglected area: the relationship between personality and academic achievement for school children in a non-Western culture. EPI or JEPI scores for black Ugandans of three different age groups were correlated with exam. results from several school subjects. The pattern of results was remarkably similar to that found in Britain.

INTRODUCTION

Warburton (1968) and Entwistle (1972) have both attempted to organise the chaos of findings relating personality variables and academic attainment. Generally, at primary school and during the first stages of secondary school stable extraverts have the advantage. Later, introverts, possibly the more unstable ones, do better. Entwistle (1972) has shown, however, that there are interactions with the sex and ability of the pupil, and the type of subjects studied, as well as with geographic area, classroom organisation and size, and teaching methods !

Cross-cultural studies, where many of the interacting variables are radically different, can examine how robust is the pattern of relationships found in the Western culture. Among university students, Kline (1966) in Ghana and Mehryar *et al.* (1973) in Iran have found similar relations to those in Britain and America. This is perhaps not surprising since universities tend to use similar teaching methods and university students tend to be the most intelligent of their age group. With school children, however, Entwistle (1972) in his extensive review found no cross-cultural investigations.

THE STUDY

It was decided, therefore, to examine the relationship between personality and academic performance at school age in Uganda. There can be no doubt that the life style of Ugandan children (e.g., Southall, 1961) is different from that of British children.

Subjects. The subjects were black Ugandans (Baganda tribe) from two rural secondary schools near Kampala. These were private schools with a wide cross-section of children, other than the brightest who were on scholarships to Government schools. Staff turnover was very high. Subjects were divided into three age groups: (1) 42 boys and 38 girls, mean age 14 years, who took the JEPI; (2) 40 boys and 35 girls, mean age 15 years, who took the JEPI; (3) 49 boys and 20 girls, mean age 17 years, who took the EPI.

Tests. Eysenck's personality tests, the EPI and the JEPI, were used. Subjects knew that the test scores were confidential and any difficulties in English were explained in standardised form. Item analysis of the test results and examination of the intercorrelations showed that the tests were valid in Uganda (Honess and Kline, 1974).

Academic attainment was assessed by the Christmas school examination. To investigate possible subject differences, English, maths., science (biology, physics and chemistry), Luganda, and history and geography scores were used.

Statistical Analyses. Correlations were computed separately for boys and girls with the different subjects (see Table 1).

RESULTS AND DISCUSSION

With our youngest age group we find extraversion almost invariably related to academic success especially among girls, where three of the five correlations are significant ($P < \cdot 05$). This finding strongly supports the Aberdeen study of Entwistle and Cunningham (1968), especially in view of the fact that Ugandans are behind their English contemporaries at school by at least one year. With the older children, none of the correlations is significant, although it is worthy of note that among our oldest girls the correlations with extraversion changes sign: introversion is more important for success. This is again in agreement with British data (Eysenck and Cookson, 1969).

TABLE 1

CORRELATIONS BETWEEN EXTRAVERSION (E), NEUROTICISM (N) AND ACADEMIC ACHIEVEMENT.
(Numbers of cases in parentheses)

	English	Maths.	Luganda	Hist./Geog.	Science
Group I					
Male E	+·095 (42)	+·231 (42)	+·314* (36)	+·129 (42)	+·120 (37)
Male N	—·137	—·071	+·189	+·006	—·014
Female E	+·338* (38)	+·127 (38)	—·125 (38)	+·313* (37)	+·366* (37)
Female N	—·196	—·438*	—·256	—·077	—·014
Group II					
Male E	+·091 (40)	+·046 (39)	—·246 (38)	No Data Available	No Data Available
Male N	—·044	+·159	—·135		
Female E	—.090 (35)	+·161 (35)	—·164 (35)		
Female N	+·057	—·143	+·169		
Group III					
Male E	+·190 (49)	+·138 (47)	—·148 (35)	+·169 (43)	No Data Available
Male N	+·192	+·232	+·224	+·165	
Female E	—·033 (20)	+·096 (20)	—·236 (18)	—·270 (16)	
Female N	+·124	—·027	+·225	+·230	

* Significant at ·05 level of confidence.

With increase in age, there is a consistent trend across all groups and subjects taught for the less stable to be more successful. A similar pattern is found in Britain for young children: high N scores are associated with poor performance (Butcher *et al.*, 1963; Entwistle and Cunningham, 1968). For older children, there *is* a change to the less stable becoming more successful; however, this may reflect the different characteristics of the highly selected sixth form (Entwistle, 1972). Unfortunately, no data are available for the Ugandan sixth form.

From this study (a pilot study interrupted by political events), it appears that Ugandan results are essentially similar to those obtained with British children, especially for our youngest age group. This is highly interesting in that we would expect with this young group home background variables to play a large part, whereas the similarity of the results across cultures suggests otherwise but indicates perhaps the strong influence of British educational methods.

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ATTITUDES TO SCHOOL SUBJECTS: A REPERTORY GRID TECHNIQUE

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SUMMARY The attitudes of 600 second-year and fifth-year grammar school pupils towards their school subjects were investigated using a repertory grid developed specifically for this purpose. Attitude dimensions of ' interest,' ' difficulty,' ' freedom,' and ' social benefit ' were isolated. Rank orders of mean scores of pupils on these four scales were produced together with inter-correlations indicating the extent to which attitudes were specific to particular school subjects.

INTRODUCTION

Interest in pupils' attitudes to science was stimulated by the publication of the Dainton Report (1968). Since then a number of scales measuring such attitudes have been published (Laughton and Wilkinson, 1970; Nuttall, 1971; Ormerod, 1971). Nuttall's NFER scale of attitudes to science produces sub-scores on science interest, social implications of science, learning activities, science teachers and school, but discussions with school pupils suggested that ' attitude to science ' was too general a dimension to be realistic. The pupils showed distinct preferences for particular subjects and it seemed unlikely that consistent attitudes towards science or arts would be found, particularly among younger pupils.

The possibility of such differences in attitudes towards related school subjects led to the development of a scale of attitudes based on Kelly's (1955) repertory grid technique. The main advantage offered by this approach is the comparison of attitudes to all school subjects in a neat format, which can be completed simply and quickly by school pupils. The development of the instrument and evidence of the reliability and validity of its constituent scales is reported.

DEVELOPMENT OF GRID

The repertory grid technique was originally designed to measure personality from personal constructs produced by the respondents themselves, but the technique has been extended into a form comparable to a two-dimensional semantic differential scale (Bannister and Mair, 1968). Responses are made by comparing a series of psychological objects on a list of polar adjectives or phrases. The adjectives used in the semantic differential scales by Osgood and his co-workers (Osgood, Suci and Tannenbaum, 1957) were claimed to fit consistently into dimensions such as ' evaluation,' ' potency ' and ' activity.' Within the Kelly system, however, it is not expected that there will be universal constructs; the descriptive words should be directly applicable to the objects being rated.

The first step in designing a grid is to identify appropriate constructs, either following Kelly's original method of evoking constructs from repeated comparisons of differing groups of objects, or by discussions. It is essential that the constructs are meaningful to the people being tested. In this study the starting point was interviews with sixth-form pupils, who were asked to explain why they had chosen or rejected various school subjects. Reasons fell into three categories:

(i) interest, or lack of interest, in the subject;
(ii) difficulty, or easiness, in relation to other subjects; and
(iii) ' worth-whileness ' of the subject in terms of its perceived social benefit.

A pilot grid was constructed using 24 bipolar constructs and administered to 120 pupils, 60 boys and 60 girls, taken from second and fifth years of a grammar school.

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[*] Dr. Duckworth is now at the National Foundation for Educational Research

The results of the pilot study indicated that some constructs were relatively ineffective and discussions with pupils allowed the constructs to be rephrased. The main weakness in the first set of constructs was that opposing phrases were too extreme. After this analysis it was possible to reduce the grid to 20 constructs, 10 of which related to ' interest,' 6 to ' difficulty ' and 4 to ' social benefit.' The format of the grid and the list of constructs are shown in the appendix.

Factor structure of the grid.

The first study with the new version of the grid used a sample of 142 grammar school pupils, equally divided into boys and girls and almost equally between second-year pupils and fifth-formers.

The procedure started by checking the elements of the grid with the pupils to ensure that the subjects mentioned were taken in that school. Pupils were then asked to take one construct at a time and rate each school subject 'A' to indicate agreement with the phrase on the left-hand side of the grid, ' B ' referring to the opposite pole, or ' O ' representing uncertainty or neutrality. Pupils were encouraged to avoid the use of the ' O ' category, if possible.

Analysis of responses to the grid involved the computation of ' matching scores ' for elements on each construct on each individual's grid in a manner similar to that suggested by Bannister and Mair (1968, page 57). Agreement in responses counted as +1, total disagreement as −1, while any combination which included a ' O ' response was treated as zero. Each construct was summed over the various elements to produce matrices of matching scores for each individual which were subsequently added, element by element, over each sub-sample to create summary matrices. From these summary matrices, coefficients ' K ' (Kappa) were calculated for the total sample (Patterns of relationships were similar in the various groups).

$$K = \frac{\text{proportion of observed agreements} - \text{proportion of expected agreements}}{1 - \text{proportion of expected agreements.}}$$

Everitt (1968) writes that " K may be interpreted as the proportion of agreement over and above that expected by chance. It can be shown to have almost the same value as the product-moment correlation for the dichotomous case." It was, therefore, considered legitimate to submit this ' correlation ' matrix of K coefficients to principal components analysis, followed by rotation to simple structure using Kaiser's ' varimax ' criterion. Five factors had eigen values in excess of unity and accounted for 52 per cent of the variance, but only three of the factors were interpretable (Duckworth, 1972).

Factors 1 and 3 could clearly be identified as ' interest ' and ' difficulty ' and corresponded closely to the dimensions intended in selecting the items. Factor 2 was less easy to define, although the items included the use of imagination and the pupil's own ideas. It was found that scores on this dimension were particularly high in rating one subject—English. Subsequently, a group of fifth-form pupils was asked in what way English differed from other subjects ; there was near unanimity that this subject provided " freedom to express one's own ideas." This factor has thus been labelled ' freedom.'

The linkage between items was investigated in two additional analyses using the ' anchor ' method, described in detail by Bannister and Mair (1968, page 69 ff), and a cluster method suggested by Fruchter (1954). The three main groups of items found by factor analysis were, with the exception of one item, substantiated by these methods and, in addition, it was possible to produce a fourth grouping of three items corresponding to the initial dimension of ' social benefit,' which is similar to a factor identified by Ormerod (1971).

One weakness in using solely statistical criteria in developing scales of this type is that conceptual uniformity may be overlooked. As a final stage in defining the four scales each item was examined for face validity and on this basis item 5 was eliminated from Factor 1. The statistical analysis led to the rejection of item 14, which had low loadings on every factor. There remained three scales of five items and one scale of three items, details of which are shown in the appendix.

Reliability and validity.

This final form of the grid was administered to 33 third-year boys and 28 fourth-year girls in grammar schools. The pupils were also asked to put their school subjects in rank order of their 'liking' for them. The rank-order correlations between 'liking' and scores on the 'interest' sub-scale were between 0·31 and 0·81 with a median value of 0·68, giving acceptable evidence of concurrent validity.

The pupils were again asked to complete the grids after an interval of between two and three weeks. Test-retest reliabilities for 'interest' and 'difficulty' sub-scales varied between 0·31 and 0·90 with a median value of 0·68. Values on the other two sub-scales were rather lower, with a median value of 0·49.

Attitudes to school subjects.

The development of the grid was the first stage in a study of pupils' attitudes to school subjects in relation to subject choice in grammar schools. A cross-sectional research design led to samples of 312 second-year and 292 fifth-year pupils being obtained from six grammar schools in Lancashire. Examination marks (second-years) and O-level grades (fifth-years) were subsequently obtained. As, at fifth-year level, some pupils had already dropped subjects and they were only asked to rate subjects they were still taking, analyses had to be based on different sample sizes for each subject. A missing-data program was used for this purpose. In the analyses of the relationships between attitudes and attainment, there were few significant correlations among second-year pupils, except in French, but a much clearer set of relationships was found among fifth-formers. A majority of the relationships were significant—positive with interest, and negative with difficulty. There was, however, a difference in the levels of correlation between groups of subjects. For English, history, geography and biology the values were rather low on average (0·15), while for mathematics, physics, chemistry and French the average value was 0·38. These groupings correspond closely to the order of difficulty perceived by fifth-form pupils in this study (Tables 1 and 2) and also with the groups of A-level subjects indicated by Forrest, Smith and Brown (1970) which attract high ability and low ability pupils. Where the subject is intrinsically easy, pupils' attitudes are less closely correlated with success than where the subject is generally perceived as being difficult.

Pupils in all sub-groups show considerable agreement as to which subjects are found both dull and difficult—mathematics, physics, French and Latin. French and chemistry change their relative popularity between second- and fifth-year samples. French is seen as easier by the fifth-formers, while chemistry is seen as more difficult, even though many of the least enthusiastic pupils will have dropped the subject by this stage. In a subsequent analysis (Duckworth, 1972) it was shown that even pupils who went on to specialise in physics and chemistry and were keenly interested in these subjects, reported them as being among the most difficult. These findings could have considerable curricular implications. Are science syllabuses now making unrealistic demands on some pupils? Such a conclusion would provide a partial explanation of the 'swing from science,' (Dainton, 1968), but the full explanation is more complex (Duckworth and Entwistle, 1974).

Finally, the use of the grid method allowed us to test the initial idea that pupils would show no general 'attitude to science,' at least in the second year. Tables 3 and 4 show the expected effect. There are few significant correlations between interest in different subjects in the second-year. Only the correlations between interest in physics and interest in both chemistry and mathematics among girls seem noteworthy. This result may imply that an identifiable group of female scientists exists even at age 12.

TABLE 1

RANK-ORDERS OF SCHOOL SUBJECTS IN TERMS OF MEAN ATTITUDE SCORES (SECOND-YEAR PUPILS).

	Interest		Difficulty		Freedom		Social Benefit	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1	Chemistry	Biology	French	Latin	English	English	English	Geography
2	History	Geography	Physics	Physics	Chemistry	Geography	Mathematics	Mathematics
3	Geography	Chemistry	Mathematics	French	Geography	Chemistry	Geography	Biology
4	Biology	History	Latin	Chemistry	Physics	Biology	Biology	English
5	English	English	Biology	Mathematics	Biology	Mathematics	Physics	Physics
6	Physics	Mathematics	Chemistry	History	History	History	Chemistry	Chemistry
7	Mathematics	Physics	History	Biology	Mathematics	Physics	French	French
8	Latin	French	Geography	English	French	French	History	History
9	French	Latin	English	Geography	Latin	Latin	Latin	Latin

TABLE 2

RANK-ORDERS OF SCHOOL SUBJECTS IN TERMS OF MEAN ATTITUDE SCORES (FIFTH-YEAR PUPILS).

	Interest		Difficulty		Freedom		Social Benefit	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1	Geography	Biology	Physics	Physics	English	English	English	Biology
2	Biology	Geography	Chemistry	Chemistry	Geography	Biology	Geography	English
3	Chemistry	English	Latin	Latin	Chemistry	Geography	Biology	Geography
4	History	History	Mathematics	Mathematics	Mathematics	Chemistry	Mathematics	Mathematics
5	English	Chemistry	French	Biology	Biology	Mathematics	Physics	Chemistry
6	Physics	Physics	History	French	Physics	Physics	Chemistry	French
7	Mathematics	Mathematics	Biology	History	History	History	History	Physics
8	French	French	Geography	Geography	French	French	French	History
9	Latin	Latin	English	English	Latin	Latin	Latin	Latin

TABLE 3

INTERCORRELATIONS BETWEEN INTEREST SCORES IN DIFFERENT SUBJECTS (SECOND-YEAR PUPILS).

	Eng.	Fr	Hist.	Geog.	Biol.	Chem.	Phys	Maths.
English	*	0·03	0·14	0·14	—0·08	0·01	—0·17	—0·09
French	0·17	*	—0·01	0·07	—0·15	—0·19	0·10	0·07
History	—0·03	—0·30	*	0·06	—0·25	0·01	—0·31	0·07
Geography ...	0·00	—0·09	0·14	*	0·11	—0·13	0·05	—0·09
Biology	0·07	—0·03	0·05	0·14	*	0·02	—0·04	0·11
Chemistry ..	0·01	—0·01	—0·01	—0·06	—0·01	*	0·10	0·09
Physics	—0·09	—0·08	—0·05	—0·04	0·08	0·33	*	0·13
Mathematics..	—0·04	0·01	0·07	—0·01	—0·10	0·13	0·22	*

girls below diagonal, boys above.

TABLE 4

INTERCORRELATIONS BETWEEN INTEREST SCORES IN DIFFERENT SUBJECTS (FIFTH-YEAR PUPILS).

	Eng.	Fr.	Hist.	Geog.	Bio.	Chem.	Phys.	Maths.
English	*	0·22	0·18	0·10	0·04	0·02	—0·37	—0·16
French	0·11	*	0·28	0·25	—0·25	—0·37	—0·28	—0·16
History . ..	0·23	—0·01	*	0·23	—0·19	—0·28	—0·36	—0·23
Geography ...	0·02	0·13	0·06	*	0·03	—0·16	—0·07	0·25
Biology	—0·13	—0·33	—0·04	—0·16	*	—0·02	0·04	—0·22
Chemistry ..	—0·16	—0·07	—0·26	—0·15	0·05	*	0·05	0·24
Physics	—0·17	—0·01	—0·06	—0·04	0·22	0·38	*	0·18
Mathematics..	—0·06	—0·13	0·01	—0·10	—0·02	0·12	0·05	*

girls below diagonal, boys above.

By age 15 the science/arts division is more clear-cut for both girls and boys, with the subjects clustering into the familiar arts/science groupings. However, even in the fifth-form, there remain sufficient differences in attitudes to specific subjects to justify the continued use of this method of measurement.

In summary, the evidence of reliability and validity reported here suggests that the use of a repertory grid technique to measure pupils' attitudes to school subjects could be of considerable value. At a time when increased emphasis is being placed in schools on helping pupils to make appropriate choices of subjects, the grid offers a compact format, simple completion and scoring, and an activity which the pupils appear to perceive as important to themselves.

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APPENDIX
REPERTORY GRID USED TO MEASURE ATTITUDES TO SCHOOL SUBJECTS

Comment A	English	Physics	History	Biology	French	Chemistry	Latin	Mathematics	Geography	Comment B	Scale
1. Rather dull and monotonous										Can be exciting	I B
2. Helps to satisfy my curiosity about life										Does not really satisfy my curiosity.	I A
3. My own ideas can be used .										Not much room for my own ideas	F A
4. Most pupils can do it quite well										Few seem able to do it well	D B
5. Usually precise and exact ..										Often vague and woolly..	not used
6 Doesn't require too much hard work										Needs really hard work ..	D B
7. Rather narrow and specialised										Of fairly general interest..	I B
8. A lot of learning by heart										Learning by heart not really important	F B
9. Needs quite a lot of imagination										Imagination seldom required	F A
10. Tends to be difficult										Fairly easy	D A
11. Knowledge useful in everyday life										Knowledge not much use in everyday life	SB A
12. Requires wide reading outside lessons										School-books and lessons enough	F A
13. Usually interests me										Often bores me	I A
14. We don't spend enough time on it										Enough time on the whole	not used
15. Important for solving world problems										Not particuarly important for solving world problems	SB A
16. Gives opportunity to think things out for myself ...										Too much of other people's knowledge	F A
17. Tends to be complicated ..										Generally straightforward	D A
18. I enjoy it more than I used to										My liking for it has decreased	I A
19. Knowledge of it helps people to understand one another										Knowledge of it doesn't seem to help in understanding people	SB A
20. Facts and ideas hard to grasp										Facts and ideas not really difficult	D A

Key to scales: I—Interest. D—Difficulty. F—Freedom. S—Social Benefit.

Method of scoring.

The second letter in the final column above indicates the response which is scored though, in practice, the 'Difficulty' dimension is better scored as 'Ease.' The 'scoring' poles are thus reversed. Agreement with the indicated pole is scored as '2,' 'O' responses are scored as '1,' disagreement as zero. The maximum score on each of the three main dimensions is, therefore, 10 and the minimum is zero.

SITUATIONAL INFLUENCES ON DIVERGENT THINKING

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SUMMARY. Three tests of divergent thinking were administered, along with Raven's Standard Progressive Matrices Test, to two matched groups of 10- to 11-year-old school children in untimed 'game-like' and untimed 'test-like' conditions. Analysis of the relative performances of the two groups showed that the removal of time limits appears to depress divergent test scores in a test-like context; it was concluded, however, that the characteristics of the test situation, and the motivations they arouse in individual subjects have more influence upon these scores than do the time limits involved.

INTRODUCTION

Wallach and Kogan (1965) showed that previously conflicting results concerning the unity and independence from IQ of the 'creativity' dimension could be attributed to the inappropriateness of the task context in many studies, and implied that meaningful conclusions could only be reached when the context was playful and non-evaluative. This view was borne out in further studies of 10- to 11-year-old school children by Pankove and Kogan (1968), Kogan and Morgan (1969) and Hargreaves and Bolton (1972); in pre-school and 6- to 7-year-old children by Ward (1968) and in college students by Cropley (1968), Cropley and Maslany (1969) and Wallach and Wing (1969). Several subsequent studies which have investigated the effects of experimental manipulation of the 'test atmosphere' upon divergent test scores have been comprehensively reviewed by Vernon (1971). Three main points of divergence between the results of these studies emerge:

(*a*) Does a game-like context increase or decrease divergent test scores in comparison with a test-like one, and are verbal and non-verbal subtests differentially affected?

(*b*) How are correlations amongst divergent tests, and between divergent and IQ tests affected by such changes in conditions?

(*c*) Are these effects caused largely by the nature of the test context, or by the presence or absence of time limits?

This latter point arises from the finding by Van Mondfrans *et al.* (1971) that a 'Take-home' condition (in which subjects were given four days to complete the Torrance Tests of Creative Thinking, 1966) produced effects upon response fluency and inter-test correlations which are associated with game-like conditions in several of the studies in Vernon's (1971) review. Since their study also included a conventional game-like condition, they concluded that the removal of time limits was a more potent factor than the nature of the atmosphere itself. The present study sets out to investigate this contention, along with points (*a*) and (*b*) above, by the adoption of an ***untimed test-like*** condition—a control which has not appeared in previous studies. If, as Van Mondrans *et al.* suggest, it is time limits which are the more potent factor, there should be no differences between the scores obtained from untimed game-like and untimed test-like conditions. If Wallach and Kogan, and other researchers who suggest that the nature of the atmosphere and the changes in motivation it arouses are more important, are correct, however, these differences *should* occur.

METHOD

Subjects. The subjects were 124 school children (64 boys and 60 girls) drawn from five Durham primary schools. The children from three of these schools were allocated to the untimed 'test-like' condition, and those from the other two to the untimed 'game-like' condition so that the two groups would be roughly equivalent in terms of numbers, mean age and mean intelligence test score. Table 1 shows the results of two t tests for uncorrelated means which were carried out to investigate possible differences in these latter two variables (*a*) between the sexes (over the whole sample of 124) and (*b*) between the ' game-like ' and ' test-like ' groups (for both sexes together). The non-significant results indicate (*a*) that any subsequent sex differences found on the divergent tests will not be attributable to spurious age or intelligence effects, and (*b*) that the treatment groups are matched for these two variables.

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TABLE 1

COMPARISONS OF MEAN AGE AND STANDARDISED MATRICES SCORES.
(N=124 ; SD in parentheses.)

	Between sexes			Between treatment groups		
	Boys	Girls	t	' Game-like '	' Test-like '	t
Age (months)	128·34 (4·01)	126·70 (5·52)	1·9 (NS)	128·11 (3·92)	126·93 (5·68)	1·3 (NS)
Matrices	110·61 (9·78)	110·13 (10·73)	0·3 (NS)	110·71 (10·26)	110·02 (10·23)	0·4 (NS)

Instruments. Three divergent tests were selected according to the recommendations of Hargreaves and Bolton (1972). These were Circles (24 items), Uses for Things (4 items) and Picture Meanings (4 items) ; all three were scored for Fluency and Originality. The group form of Raven's Standard Progressive Matrices (Revised Order, 1956) was administered as a reference intelligence measure. Raw scores were converted to the equivalent of standard IQs according to the age norms provided in the test manual (Raven, 1960).

Procedure. All four tests were administered in group form in one session in each of the five schools. Subjects in both treatment groups were first shown, with the aid of examples, how to do each of the three divergent tests. In order to prevent the children from looking at each other's responses, individual enterprise was stressed ; they were encouraged to " think of ideas that no one else will think of." The children in both treatment groups remained sitting in their places throughout, so that ' copying ' effects were minimised. They were given unlimited time to complete the divergent tests in any order, spending as much time as they liked on each, and going back to previous tests as they pleased. When all had finished, the Matrices test was administered under standard conditions.

The children in the two ' game-like ' subgroups were introduced to the experimenter by their class teacher as " someone who has come to talk to you." The teacher then left the room and the experimenter (who was casually dressed) talked informally for a few minutes, emphasising the playful, non-competitive nature of the 'games.' Answer forms for the divergent tests, which had no official headings or written examples, were handed out ; examples of typical test items were verbally conveyed. During the divergent tests, no restriction was placed on the children's behaviour except when the noise level became sufficiently great to disturb other classes.

In the three ' test-like ' subgroups, the tests were administered by the experimenter (more formally dressed on these occasions) in the presence of the class teacher. The tests were introduced as such, and headed answer forms, which included examples of possible responses to each test, were distributed. The children were taken through these examples by the experimenter, as in the 'game-like' group. Silence was observed during all four tests, and the class teacher urged the children to " do as well as possible."

RESULTS

The differences in performance between the two treatment groups, and the potential effects of sex differences were investigated by a 2×2 analysis of variance for each of the six divergent test subscores ; the summary tables for these analyses appear in Table 2. Since there are no significant main effects for sex, and only one significant interaction (girls improving more than boys on ' Picture Meanings—Fluency ' in the ' game-like ' as distinct from the 'test-like' condition), subsequent analyses of relationships between the variables were carried out for the sexes combined. Table 3 shows the means and standard deviations of the six divergent test subscores of each treatment group (for both sexes combined). Product-moment intercorrelations were calculated between each of the seven test scores for each group; these appear in Table 4.

TABLE 2

The Effects of Test Atmosphere and Sex Differences on the Six Divergent Test Subscores

(Analysis of variance summary tables, N = 124).

Subscore	Source of Variance	df	Mean Square	F	P
Circles—Fluency	Atmosphere	1	357·79	6·74	< ·05
	Sex	1	101·73	1·92	NS
	Atmosphere × Sex	1	203·52	3·83	NS
	Within cells	120	53·09		
Circles—Originality	Atmosphere	1	379·57	2·77	NS
	Sex	1	343·01	2·50	NS
	Atmosphere × Sex	1	429·15	3·13	NS
	Within cells	120	137·04		
Picture Meanings—Fluency	Atmosphere	1	813·95	12·59	< ·001
	Sex	1	15·95	<1·00	NS
	Atmosphere × Sex	1	639·39	9·89	< ·01
	Within cells	120	64·68		
Picture Meanings—Originality	Atmosphere	1	3021·22	7·55	< ·01
	Sex	1	40·58	<1·00	NS
	Atmosphere × Sex	1	927·29	2·32	NS
	Within cells	120	400·37		
Uses—Fluency	Atmosphere	1	19·72	<1·00	NS
	Sex	1	10·31	<1·00	NS
	Atmosphere × Sex	1	44·68	1·64	NS
	Within cells	120	27·28		
Uses—Originality	Atmosphere	1	3·91	<1·00	NS
	Sex	1	201·53	2·09	NS
	Atmosphere × Sex	1	366·04	3·80	NS
	Within cells	120	96·27		

TABLE 3

Means (SD in parentheses) of the Six Divergent Test Subscores for Each Treatment Group (Sexes Combined).

Subscore		' Game-like ' (N = 65)		' Test-like ' (N = 59)	
Circles	Fluency	22·55	(8·91)	19·15	(5·24)
	Originality	13·38	(14·06)	9·88	(8·87)
Picture Meanings	Fluency	15·55	(10·76)	10·42	(5·95)
	Originality	20·48	(26·00)	10·59	(9·96)
Uses	Fluency	12·82	(5·44)	12·02	(4·98)
	Originality	8·83	(9·62)	9·19	(10·33)

TABLE 4

INTERCORRELATIONS BETWEEN THE 7 TEST SUBSCORES FOR EACH TREATMENT GROUP (' GAME-LIKE ' GROUP, N=65, ABOVE DIAGONAL ; ' TEST-LIKE ' GROUP, N=59, BELOW DIAGONAL).

Subscore	Circles		Picture Meanings		Uses for Things		Matrices
	F	O	F	O	F	O	IQ
Circles :							
Fluency		·75	·28	·31	·26	·33	·47
Originality	·63		·37	·41	·19	·38	·46
Picture Meanings :							
Fluency	·03	·02		·95	·61	·65	·26
Originality	·08	·05	·90		·53	·68	·27
Uses for Things :							
Fluency	·01	·12	·55	·46		·72	·12
Originality	·06	·18	·49	·47	·60		·29
Matrices IQ	·14	·11	·03	—·07	·04	·11	

Correlations of 0·25, 0·33 and 0·41 are significant at the 0·05, 0·01 and 0·001 levels respectively.

DISCUSSION AND CONCLUSIONS

Comparisons between the treatment groups on the divergent tests.

Tables 2 and 3 show that the ' game-like ' condition produces significantly higher scores than the ' test-like ' one in both subscores of the Picture Meanings test, and in the Fluency score for Circles, but that there are no significant differences for Uses for Things, or for Circles—Originality. It appears that these effects are stronger for non-verbal than for verbal tests ; the inconsistencies in this pattern (such as the absence of a significant atmosphere effect for Circles—Originality) possibly reflect the popularity of the different tests, since subjects were free to apportion their time. The main conclusion, however, is that the general superiority of game-like conditions has been demonstrated over *untimed* test-like conditions ; it appears, therefore, that the characteristics of the situation, and the motivations they arouse in individual subjects, are more important than the time limits involved in facilitating divergent thinking.

Intercorrelation analysis.

The inter- and intra-divergent test correlations in Table 4 confirm Wallach and Kogan's (1965) view that game-like conditions are more appropriate for the assessment of a unitary ' creativity ' factor than are test-like ones ; the mean coefficient dropping from 0·49 ($P < \cdot 001$) in the ' game-like ' to 0·31 ($P < \cdot 05$) in the ' test-like ' condition. The pattern of correlations between the divergent and the Matrices tests, however, departs strikingly from that of most of the studies reviewed by Vernon (1971). In these, correlations between divergent and intelligence test measures have either been higher in test-like than in game-like conditions, or of the same order in both groups. In the present study, however, the figure for the ' test-like ' condition is much lower: mean coefficient 0·06 (NS) as compared with 0·31 ($P < \cdot 05$) in the ' game-like ' group.

This latter figure is of the order that might be expected from a sample of subjects whose mean Matrices score is equivalent to an IQ of 110 ; the surprising result is the zero-order level of the former. The difference between this figure and the corresponding ones of other studies is probably the result of the ' test-like ' condition itself being different; it may well arise from the way in which untimed conditions interact with a test-like atmosphere. Normal timed, test-like conditions ensure that subjects spend the prescribed amount of time on each divergent test. In the present *untimed* test-like conditions, however, children were completing each of the three tests as quickly as possible and not returning to previous ones as they were free to do; as a result, they were not spending as much time on each as they would otherwise have done.

In other words, it appears that the removal of time limits actually depresses divergent test scores when the atmosphere is test-like; children feel less inclined to return to other tasks at leisure, and want to ' finish off ' the tests as speedily as possible. This interpretation is supported by the results of Table 3 , five out of the six mean subscores are lower in the ' test-like ' group. This depression results in a lowering of correlations with the Matrices scores, which are more typical of the true abilities of the subjects. The objection that this lowering of correlations might be due, in part, to a restriction of range effect is minimised by the results from Uses for Things. The correlations of this test with the Matrices scores are lower in the ' test-like ' group in the absence of such an effect, as the standard deviations of Table 3 show.

These findings provide more insight into the ways in which individual motivations are aroused by the characteristics of the ' test-like ' situation Since time limits are normally implicit in such a situation, their removal causes ambiguity; subjects apparently try to overcome this by setting their own limits, and behaving in a conventional ' test-like ' manner. Tests of divergent thinking provide a valuable means for studying this kind of interaction between cognitive and motivational variables ; we can look at *how* responses are obtained rather than merely at *what* they are, and thereby gain insight into the psychological processes which determine test performance.

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THE EFFECT OF REGIME ON DIVERGENT THINKING SCORES

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SUMMARY Parallel groups of pupils were subjected to ' relaxed ' and ' test ' regimes when completing two convergent tests and six divergent thinking tests. The subjects, 48 boys and 68 girls, covered the full ability range of a large comprehensive school. Results indicated that the imposition of mild stress (' test ') generally increased pupils' scores on these tests compared with those obtained under a relaxed or informal regime.

PROCEDURE

The aim of the inquiry was to assess the validity of the claim that divergent thinking instruments should be administered under relaxed conditions for optimum performance. Wallach and Kogan (1965) claimed a high degree of reliability for their tests when administered under relaxed conditions. An experimental design was, therefore, adopted in which, after a first testing under relaxed conditions, half the sample repeated the tests under formal test conditions while relaxed conditions were repeated with the other half of the sample.

Sample. 205 third form children in a 10-form entry coeducational comprehensive school were used. The school divides its intake into three ability bands, and two parallel classes in each band were selected to give a complete cover of the ability range.

Test Materials Six measures of divergent thinking were used : five of the Wallach and Kogan instruments, Line Meanings, Pattern Meanings, Instances, Alternate Uses and Similarities, together with Torrance's Drawing Completion test (squares and circles), giving three verbal and three non-verbal tests. Each test was divided to give parallel forms termed Form A and Form B. Two measures of convergent thinking were also applied : parallel forms of the Mill Hill vocabulary scale, and Raven's Progressive Matrices divided into odd and even numbered items, to give parallel forms of convergent verbal and non-verbal tests.

Divergent tests were scored for fluency and originality only, originality being assessed by the weighting procedure suggested by Cropley (1968).

Administration. The first testing was in January and the second in May. To obtain the relaxed regime essential for this investigation some time was spent establishing a friendly relationship using examples of poems and humour collected from secondary pupils. All pupils were asked if they would participate, none was forced to do any exercise and all ' tests ' were treated as games. Significantly, only six blank returns were received throughout the whole period of the investigation. Each class was divided randomly so that half did Form A and half did Form B. Within each ability band one class did all the items under relaxed conditions on both occasions, whilst the other class experienced relaxed conditions for the first visit and test regime on the second occasion.

The test regime involved setting up examination-type situations with clear spacings between pupils, strict procedures to follow if fresh paper was required, and so on. For this occasion, and these classes only, the pupils were also told that these were psychological tests and that they would be scored and assessed like intelligence tests and that their scores, but not their actual replies, would be given to the school.

The variables involved were Occasion (two different visits), Form (all tests were divided to yield Form A and Form B), Order (pupils doing A first did B second and *vice versa*), Sex (both boys and girls involved), and Regime (some instruments were given under relaxed and some under test in Occasion 2). Sex and Order may be considered factorially pure. Regime and Occasion are interacting since all Occasion 1 scores are relaxed but half of Occasion 2 are relaxed and half test regimes.

The influence of regime on scores was assessed by setting up pairs of corresponding two-way analyses of variance, i.e., relaxed /relaxed and relaxed /test. Two pairs of analyses were made, one for girls and one for boys. Each pupil was given a number based on their alphabetical order. To equate group sizes a random selection of these numbers was used to yield boys' groups of 12 and girls' groups of 17. Thus, the first analysis for boys concerned scores obtained by 12 boys who did Form A first with Form B second and another 12 who did Form B first with Form A second.

The first analysis for girls concerned scores obtained by 17 girls who did Form A first with Form B second and another 17 girls who did Form B first with Form A second. In both cases these analyses concerned scores obtained entirely under relaxed conditions.

The variables involved were Order (A first B second *versus* B first and A second), and Occasion (first visit *versus* second visit). In this way the impact of Order and Occasion can be shown. In the second analysis the same two variables, Order and Occasion were involved. In this case, however, Occasion 2 involved a difference of regime. Similar group sizes were selected, namely 12 for boys and 17 for girls. Thus, for the boys the second analysis involved the scores of 12 who did Form A first (relaxed) followed by Form B second (under test conditions), and the scores of another 12 who did Form B first (relaxed) followed by Form A second (under test conditions). The same arrangement was followed with the girls groups of 17. Any difference between the impact of occasion determined in this second analysis and that obtained in the previous one may be considered to be due to the regime variable involved.

RESULTS AND DISCUSSION

When F values and probability levels were determined it was found that the Order variable, i.e., whether Form A or Form B was taken first, was not significant in any test with either boys or girls. Similarly, the Occasion variable for pupils experiencing relaxed regimes for both visits was not significant for boys, with the exception of Instances Fluency. For girls, seven tests showed significant P values for the Occasion variable and five of these were for verbal tests. In the results each test yields two means for every occasion, one for Form A and the other for Form B. If these two means are added a sum of means for each test is obtained. Table 1 presents the results for both Occasion 1 and Occasion 2 for Boys Group 1 (N=24, relaxed /relaxed /, and Occasion 1 and Occasion 2 for Boys Group 2 (N=24, relaxed / test). The difference and direction between occasion for these groups shows that for boys divergent thinking scores tend to be higher under test conditions compared with relaxed ones, although Drawing Completion and Instances Fluency are exceptions. The Mill Hill Scale shows a slight decrease on Occasion 2 whether under test or relaxed conditions. The non-verbal convergent test, Raven's Matrices, is slightly influenced by test conditions

TABLE 1

SUMS OF MEAN SCORES FOR OCCASION 1 AND OCCASION 2 FOR EACH TEST.

	Boys 1, N=24 (relaxed/relaxed)			Boys 2, N=24 (relaxed/test)		
Regime	Relaxed	Relaxed	Diff.	Relaxed	Test	Diff.
Occasion	(1st)	(2nd)		(1st)	(2nd)	
Instances fluency	66·1	52·0	—14·1	74·8	64·9	—9·9
Originality..............	59·4	53·8	—5·6	70·6	72·1	+1·5
Alternate Uses .... . F	19·4	19·9	+0·5	22·6	25·9	+3·3
O	24·6	21·3	—3·3	26·8	34·2	+7·4
Similarities .... F	32·5	28·7	—3·8	32·7	33·9	+1·2
O	13·4	15·0	+1·6	19·5	29·8	+10·3
Line Meanings . ....F	22·0	24·1	+2·1	23·3	35·0	+11·7
O	29·6	35·9	+6·3	32·8	56·8	+24·0
Pattern Meanings....F	14·3	16·6	+2·3	14·4	22·8	+8·4
O	28·1	30·3	+2·2	27·4	42·0	+14·6
Drawing Completion F	20·8	19·4	—1·4	23·7	20·6	—3·1
O	29·6	23·5	—6·1	33·5	26·2	—7·3
Mill Hill Scale	42·6	42·2	—0·4	43·5	42·1	—1·4
Raven's Matrices	46·3	47·9	+1·6	42·1	46·2	+4·1
Totals........	—	—	—18·1	—	—	+64·8

— =Occasion 1 greater than Occasion 2. + =Occasion 1 less than Occasion 2.

TABLE 2

SUMS OF MEAN SCORES FOR OCCASION 1 AND OCCASION 2 FOR EACH TEST

	Girls 1, N=34 (relaxed/relaxed)			Girls 2, N=34 (relaxed/test)		
Regime	Relaxed	Relaxed	Diff.	Relaxed	Test	Diff.
Occasion	(1st)	(2nd)		(1st)	(2nd)	
Instances fluency	83·1	67·1	—16·0	81·6	84·9	+3·3
Originality	75·5	64·8	—10·7	77·0	87·2	+10·2
Alternate Uses F	22·2	26·2	+4·0	25·1	29·6	+4·5
O	26·9	31·6	+4·7	32·5	34·1	+1·6
Similarities F	36·6	39·7	+3·1	41·1	43·8	+2·7
O	19·6	28·6	+9·0	25·1	31·9	+6·8
Line Meanings F	23·7	29·6	+5·9	27·2	44·2	+17·0
O	31·7	37·6	+5·9	40·0	67·0	+27·0
Pattern Meanings F	19·6	22·9	+3·3	19·3	31·9	+12·6
O	31·3	36·3	+5·0	32·7	60·8	+28·1
Drawing Completion F	25·1	27·1	+2·0	29·0	30·2	+1·2
O	26·0	29·4	+3·4	36·7	34·5	—2·2
Mill Hill Scale	41·0	43·0	+2·0	41·4	42·6	+1·2
Raven's Matrices	46·4	47·9	+1·5	46·6	46·7	+0·1
Totals	—	—	+23·1	—	—	+114·1

—=Occasion 1 greater than Occasion 2. +=Occasion 1 less than Occasion 2·

The result comparing girls' mean scores for each test is shown in Table 2. The same trend for test conditions to increase scores is shown. Only for Drawing Completion Originality is this not true. Under relaxed conditions for both occasions there are large falls in Instances, Fluency and Originality scores, but all other items show increases on the second testing. The convergent tests appear to be a little more stable though the increase in Mill Hill scores for Occasion 2 under-relaxed conditions is significant at 5 per cent level. Differences between scores for Raven's Matrices are not significant, and under test conditions there is only a marginal increase in score.

CONCLUSIONS

For boys it seems that test conditions produce higher average scores in these divergent tests than relaxed ones. This is particularly shown by non-verbal instruments. There is some tendency for improvement in scores on the second occasion irrespective of regime, but test conditions seem to sharpen this distinction.

It is possible that the girls treated all occasions alike and acted under some constraint to do well even under relaxed conditions. Certainly, their scores are generally higher than boys' and their divergent thinking scores are much higher. However, it seems that, irrespective of sex, the relatively mild test conditions used here with these instruments cause scores to improve, particularly divergent thinking ones. This improvement is not limited to fluency, and the argument that original ideas are less frequent under stress is not supported by these results.

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CRITICAL NOTICE

APTITUDE TESTS FOR HIGHER EDUCATION?

By N. J. ENTWISTLE

(Department of Educational Research, University of Lancaster)

B. H. L. Choppin *et al.* (1972). *After A-Level? A Study of the Transition from School to Higher Education.* Slough: NFER, pp. 33, £0·50.

B. H. L. Choppin *et al.* (1973) *The Prediction of Academic Success.* Slough: NFER, pp. 70, £1·10

J. L. Powell (1973). *Selection for University in Scotland* London: University of London Press (Publications of the Scottish Council for Research in Education, 64), pp. 100, £0·80.

The two research studies reported in these three publications both had their origins in discussions of the Robbins Committee prior to 1963. Two of the Committee's recommendations related to possible changes in the selection of students for higher education.

" Institutions of higher education and the schools should jointly consider how school records and recommendations can best contribute to the process of selection . . . " (para. 229).

" There should be research by an independent body into the extent to which aptitude tests might supplement other features of the selection process " (para. 232, Robbins' Report, page 277)

Through the initiative of one of the members of the Robbins' Committee, James Drever, the Scottish Council for Research in Education was able to begin collecting data in anticipation of the committee's recommendations. In England, it was not until 1966 that an equivalent investigation was mounted and even then the project was under the control of an ' interested party,' the Committee of Vice-Chancellors and Principals Perhaps for this reason the subsequent flow of research information from this project seemed at times to be constrained in a way not normally encountered in British educational research

The two projects had aims and procedures in common. The idea was to obtain supplementary predictive information from head teachers' estimates of academic potential and also from the results of aptitude tests administered six months or more before pupils sat 'A' levels or 'Highers.' Admissions tutors in higher education would thus have evidence beyond ' O ' level grades on which to base their provisional offers Both studies investigated the school achievement and aptitude scores of pupils entering different sectors of higher education and also looked for evidence of the validity of head teachers' estimates and of aptitude tests in predicting degree results of university entrants. The evidence is not complete, but the three reports taken together probably answer most of the important questions.

In the Scottish study 9,801 pupils from 218 schools " met the criterion for inclusion . . . (and) can be regarded as constituting a virtually complete annual cohort." The sample entering the five well-established Scottish universities consisted of 2,781 students, all but 59 of whom were included in the final analyses There can thus be no doubt at all about the representative nature of this sample of Scottish students—a tribute to the thoroughness with which the study was conducted.

The main criterion used to assess validity was a simple dichotomy (pass/fail) based on degree result. Predictor variables included a variety of measures derived from performance in Scottish ' Highers,' teachers' scaled estimates of ' Higher ' grades, head teachers' estimates of degree potential, and verbal and mathematics scores from the American Scholastic Aptitude Test

In the project organised for the Committee of Vice-Chancellors and Principals responsibility for the validation of their experimental test of academic aptitude was passed on from the project directorate to the NFER. Over a three-year period 65,000 sixth-formers had taken successive versions of aptitude tests based on Professor R. A. C. Oliver's adaptation of the Scholastic Aptitude Test. The two reports so far available from the NFER's School to University Research Unit concern a sample of 27,315 sixth formers from 619 schools which entered candidates for the 'A' level examinations of either the JMB or the London Board. Of these, 7,247 students entered universities in 1968 and 7,080 were included in the analyses.

The main criterion in this second study was a six-point scale related to degree class, while predictor variables included a school assessment, school performance at ' O ' and 'A' levels, and the mathematical and verbal aptitude scores. The methods of analysis used in both studies were essentially the same. Simple correlations, multiple correlations and threshold analyses were reported for different areas of study. (Sex differences were generally found to be of little significance.)

Summary of Results.

The main findings can be summarised as follows :

(1) The first NFER report shows clearly that university students have much higher aptitude scores on average than students entering other sectors of higher education, although there is overlap. The degree of overlap is shown graphically by constructing an ellipse including students lying within one standard deviation of the group mean. The college of education ellipse shows only a small overlap with that of universities. At the time of this survey it is clear that polytechnics, and further education instructions in general, were being more successful than the colleges of education in recruiting able students. This conclusion is also supported by the schools' assessments of their pupils : college of education students were rated lower even than pupils not entering higher education at all.

(2) The same report shows differences in aptitude scores and 'A' level grades of students entering different fields of study in universities and colleges. As expected, with the competition to obtain places in arts faculties, the rank order in terms of mean 'A' level ' score ' was arts, social sciences, science and technology. The aptitude scores were less easy to interpret. In terms of the combination of verbal and numerical scores the scientists appeared to be rather more able, as a group, than their 'A' level grades might suggest. A similar contrast has been reported elsewhere (Entwistle, Percy and Nisbet, 1971). In the Scottish study, students in the science faculties had higher mean scores in Highers than had any other faculty.

(3) Simple correlations between head teachers' ratings of suitability for university and degree performance were around ·25 in both studies. This value is well below the value obtained from mean grades at 'A' level or with Highers. However the use of teachers' estimates of grades in Highers, after scaling against actual results for the class, proved to be as good predictors of degree performance as the grades themselves.

(4) The use of the academic aptitude tests was less fruitful. Simple correlations between aptitude scores and degree results in the Scottish sample ranged between ·00 and ·27 with a median value of ·10. In the NFER sample comparable correlations ranked between —·12 and ·29 with a median value of ·08. Within narrower subject groupings the separate aptitude tests did fare rather better, in a predictable fashion. Mathematics aptitude correlated ·32 with degree results in mechanical engineering and ·23 in physics. Verbal aptitude correlated ·26 with degree results in history and ·21 in English.

(5) In both studies, among pre-entry measures, the best prediction of future academic performance came from external examination performance. Correlations of mean 'A' level grade with degree performance varied between ·19 in arts faculties to ·42 in engineering with a median value of ·28. In Scotland rather higher overall correlations were obtained with a median value of ·39 from a comparable mean grade variable.

(6) The possible use of aptitude test scores hinged on whether this supplementary information would improve the level prediction of academic performance otherwise obtained. In other words one of the key analyses in establishing the validity

of the tests of academic aptitude was the effect of including these scores in multiple regression equations. The Scottish study emphasises the importance of this evidence. " When stepwise multiple regression was undertaken Scholastic Aptitude Test predictors (being less highly intercorrelated with the SCE (Highers) predictors than were the SCE predictors with one another) had a certain advantage for inclusion in the regression equations as second or third elements. The fact that they rarely did so is an indication of just how poor they were as predictors " (page 41). The NFER did not use the stepwise approach. Their main concern was to see how the value of multiple correlations increased when aptitude scores were added to other information. Taking all courses together the combination of school assessment and number of ' O ' level passes produced a multiple correlation of ·28. Adding both aptitude scores to the analysis boosted the correlation only to ·30. The same minimal increase was obtained when the aptitude scores were added to the combination of ' O ' level, 'A' level and school assessment measures. The multiple correlation was lifted from ·40 to ·42.

(7) The variable which produced the highest simple correlations with degree result is not much help to admissions tutors. In the NFER survey first-year performance correlated with degree performances around ·5 and in the Scottish study values estimated at around ·7 were obtained.

(8) Finally both studies looked for evidence of a possible threshold effect. The Scottish report states: " One serious possibility to be faced is that ability operates as a threshold variable—that is, that provided one has a necessary minimum, larger amounts have little effect " (page 64). This possible explanation of poor prediction from the scholastic aptitude test was, however, rejected. The NFER report tackles this possibility in a different, and interesting way. " It may be that . . . the relevant key to the validity of the test of academic aptitude is not the measure of its correlation overall with university performance, but rather its ability to identify applicants who are likely to fail . . . Cut-off selection methods applied to GCE results are in widespread use by the universities, although there are few figures available to justify the choice of particular thresholds " (page 53). Examining the threshold effect for 520 mathematics students for a cut-off equivalent to CCD, the first-year failure rate for those above the threshold value was 13 per cent; for those below the threshold the equivalent value was 46 per cent. This clear evidence of the value of using a cut-off value was less positive for 'A' levels in other subjects. " In general, the use of a qualifying A-level standard would slightly reduce the proportion of failing candidates, while the use of aptitude scores would have only a random effect . . . " (page 55).

In the end the most important question seems to be, " Did the use of academic aptitude scores help in the prediction of subsequent academic performance ? " The evidence summarised above appears unequivocal, but the NFER report retains a flicker of optimism. " The test of academic aptitude appears to add little predictive information to that already provided by GCE results and school assessment in general. There are indications, however, that in certain fields of academic study it can be quite valuable " (page 63). The basis of this optimism is not immediately clear: perhaps it relates only to simple correlations in certain specific subjects. It certainly cannot be drawn from what would seem to be the more important evidence from the regression analyses. " The combination of school assessment and the number of passes at ' O ' level (approximates) the information available to universities when they are first considering applications . . . By adding the TAA scores to this combination an approximation is made to a possible situation in which TAA may be in use. The contribution of the test scores in this situation can be assessed from the increase of the correlations, typically by only 0·02 to 0·03 and rarely by more than 0·05 " (page 48).

The Scottish report is in no way optimistic : " The investigation has provided no grounds for supposing that the introduction of a Scholastic Aptitude Test such as the one employed would be of any value in selection for university entry in Scotland either as a sole predictor or as a predictor supplementary to SCE performance " (page 41).

From this evidence there seems to be little future for these tests of academic aptitude as selection instruments in British higher education. The research evidence does, however, show a potential use which could be important. There is good reason to expect that TAA might be appropriately used for examining trends of entrance into the different sectors of higher education and also for monitoring the ability levels of sixth-formers taking different groups of 'A' level subjects. There is clearly a need to try to equate standards of marking between examination boards and, as far as possible, between different subjects within each board. In other words, TAA may well have a future as a research instrument and as a measure of *group* differences. It cannot have a future as a device used as part of the procedure for selecting *individual* students. This conclusion will, no doubt, be a disappointment to at least some members of the Committee of Vice-Chancellors and Principals—which leads us back to their role in the validation exercise.

In organising their research project the Committee of Vice-Chancellors and Principals clearly had a difficult task. They had undertaken to validate the test, but they were also the body primarily concerned with plans for future implementation. The directorate was thus having on the one hand to prepare public opinion for the possible use of what might be taken as a 'later-age' 11+ test and on the other hand, objectively to evaluate the evidence about validity. The first task involved convincing people that the test would add usefully to the predictive information available without invidious side-effects. The validation exercise, once preliminary results began to become available to the directorate, threatened to demonstrate the uselessness of the test for the purpose of selecting individual applicants (Entwistle, Percy and Nisbet, 1971). Some conflict between functions was inevitable and eventually the validation function was transferred to the NFER. However, a residue of this conflict may be seen in the introduction to the first report of the NFER where some curious obfuscation is directed towards research workers and general public alike. " The Project Committee's belief in the possible value of an aptitude test rests less on theoretical foundations than on ample empirical evidence that in North America and elsewhere what it measures has some consistency and stability, and that the marks or scores correspond to a useful degree with indices of later performance in academic careers" . . . "It is easier to say what an aptitude test is not than to define what it is. It is not a subject examination or an achievement test, as there is no syllabus or any defined body of subject content that it sets out to examine. Basically it tries to assess ability to handle words and numbers and may be thought of as a generalized examination, not related closely to particular subject areas. It is not designed as an intelligence test: it eschews psychological theories of the nature of intelligence. Intelligence does come into it, as in all examinations, but it is not simply another intelligence test, whatever that term may mean " . . . "Academic capacity can best be measured by questions of two kinds, essentially verbal or mathematical . . . The verbal questions include tests of reading comprehension, sentence completion, antonyms, analogies and verbal discrimination " (*After A-Level*, pages 2-3). Any connection between this test and those ' discredited ' tests of intelligence or verbal reasoning must presumably be purely coincidental, but puzzling.

Leaving aside the public relations aspects of this project, there are interesting psychological issues to discuss. Why did this test apparently fail to live up to the high expectations expressed in the preceding quotation ? It worked in North America ; why not in Britain ? But how well did it work in the USA? Was its predictive validity consistently high ? In reviewing the literature it appears that,in fact, the level of prediction is highest in colleges heterogeneous in the ability levels of entrants and a good deal lower where the colleges are more selective. Evidence of this type would immediately suggest some pessimism about its usefulness in Britain. Moreover, there are important differences between the criterion of academic performance used in the two countries. In USA the grade-point average is the outcome of students being assessed on a wide variety of courses from a number of areas of study. In England most students are awarded honours degrees in specific subjects. We should again anticipate good predictive validity only when the aptitude measured is closely similar to the intellectual skills required in that particular subject area. The NFER results bear this expectation out, although the predictive validity is still not high even in such cases.

It is arguable that the conception of these studies was at fault, although the quality of meticulous research shown in all the reports is not in doubt. Why, for example, was the same test of academic aptitude used on all 65,000 school children ? Would it not have been more sensible to explore the usefulness of a variety of tests, particularly experimental tests which would tap a much wider range of high-order intellectual skills, rather than put so much trust in a rather old-fashioned instrument? It is always easy to be wise after the event and probably in the sixties, no research worker could have been expected to anticipate the type of tests now being developed in Australia.

From a practical point of view it looks as if admissions tutors have been left precisely where they were—but not quite. Both studies have explored the extent to which we can put our trust in 'A' level grades in selecting students for higher education. Certainly they are the best predictive measures we have available, but it is clearly absurd to put much faith in precise cut-offs of grades in selecting students. Administratively, it may be necessary, but we should not delude ourselves that academic standards would be threatened by the lowering of a grade here or there. The lack of predictive validity from everything except first-year performance indicates that the experiences presented to students in higher education are so different, particularly in terms of freedom in studying and treatment of the subject matter, that no pre-entry measure is likely to be adequately predictive. But admissions tutors do have a difficult problem and a tiresome administrative burden. UCCA forms have to be scrutinised before provisional offers can be made, perhaps after interview. In August pupils who have failed to reach the required level have to be reconsidered.

Is this exercise justified when the grades themselves represent a rather fallible index of academic potential ? Could we short-circuit this intricate process without serious loss of accuracy ? The Scottish report contains an indirect hint of how this might be done. Teachers' estimates of grades, scaled against actual grades subsequently obtained, were indistinguishable in their predictive validity from the grades themselves. Would teachers' estimates of grades scaled against the previous year's results be much less useful ? Schools have records of the grades awarded. UCCA could require teachers to provide estimates of grades of applicants following the distribution of grades awarded in the previous year with discretion to alter this distribution by up to say 10 per cent either way to allow for known changes in the ability level of the year group indicated by ' O ' level grades. The UCCA form would then come to admissions tutors with reliable anticipated grades recorded on it. On the basis of these grades universities could, with some confidence, make what would amount to an almost unconditional offer. In the event of a disastrous actual performance the university would have to reserve the right to withdraw the offer. It would also have to retain a number of places to offer to applicants, rejected on the basis of their anticipated grades, who did well in the examinations. At first sight this seems a workable and tolerably fair scheme which would involve less work. (The form of scaling involved is straightforward and undemanding of time.) Its predictive validity would amost certainly be much higher than any scheme using aptitude testing or head teachers' ratings of academic potential.

It is the strength of thorough research of this type that the germ of an idea may be thrown up accidentally as a by-product of the main study. The reports are short and well worth reading : others may well see other practical implications in the findings.

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BOOK REVIEWS

ADAMS, M., and LOVEJOY, H. (1972). *The Mentally Subnormal: Social Work Approaches*. London: Heinemann, pp. 296, £3·50.

The book consists of a series of nine contributions by workers concerned with different professional aspects of the field of mental handicap. All are concentrated but clearly and readably presented: the editors, who are themselves contributors, have managed to avoid the unevenness so frequently found in books drawing together the work of different subscribers

From a broad survey of the history of the legal and administrative context for services for mentally subnormal children and adults, which sets the theme for the book, there follows an outline of the principles for medical and social casework treatment and intervention in which the concept of mental handicap is examined in detail and the dangers of convenient classification illuminated. Later are chapters describing school, day and residential settings and provision for dealing directly with this handicap, and an analysis of the opportunities for training and employment available for handicapped adults. A concluding chapter reviews the more significant research into the differing problems of social adjustment associated with mental handicap and draws out implications for the development of future services Taken as a whole, the book provides a conceptual framework which allows for a holistic view of such services.

Throughout there is an emphasis not only on work with the mentally subnormal person but also on the need to ensure the evolution of family services: what are the family's reactions to each other and to the kinds of decisions made by professional workers, what factors determine these decisions and what alternatives are available? Throughout also is an analysis of other questions facing workers in this field: what sort of priority—and why—should such services get, what kind of preventive and counselling services can be developed, and by what criteria should services be evaluated? Far from acclaiming that casework and the development of community responsibility are incompatible the reader is left with the impression that the future of social work with the mentally handicapped lies in discovering how to provide services in the widely different forms that will be most effective for different kinds of people. Throughout the book is the recurring theme that mentally handicapped people can be helped if it is realised that understanding of the whole person, home background, and individual difficulties is a basic requirement, and that the casework intervention should be adapated and modified to individual needs. Who can dispute that this is the ideal to be aimed for whatever difficulties there may be in putting it into practice?

The first edition of this book was published in 1960, and at that time looked forward confidently to an expansion, quantatitively and qualitatively, to existing services; what is abundantly clear is that while some aspects of services have improved, for example in the number of trained workers and in the content of training, some other aspects, particularly residential facilities, have deteriorated. Mention must be made here of a recently published study which is not mentioned in this book: in *Plans and Provision for the Mentally Handicapped*, by Bone, Spain and Martin, this decline in the demand for long-term residential care is analysed as a reflection of the growth of community provision. Clearly, though, in the 12 intervening years between the two editions much has been done, but the book highlights what remains to be done.

Unlike other recent publications, such as the one noted above and McLachan's *Approaches to Action*, this book does not add to knowledge in this field, but it does bring together a clearly documented and carefully assessed picture of present approaches to diagnosis, assessment and care, and offers a model for development of services for the mentally handicapped as they enter adult life in the community. As the editors argue, further developments in this field will require changes in the roles of workers, an emphasis on research, and more collaborative administrative machinery at local and national levels.

Teachers, parents, doctors, psychologists and social workers will find interesting reading but the book will be most valuable in giving a perspective to new recruits to professional social work or those approaching this aspect for the first time.

ALAN GORDON

BUTCHER, H. J., and LOMAX, D. E. (1972). *Readings in Human Intelligence.* London: Methuen, pp. 438, cloth £3·50, paper £1·50.

Readers who have found Butcher's lucid and wide ranging *Human Intelligence* to be an important item on their reading lists, will welcome this book of readings. The readings are specifically designed to provide familiarity with authors or schools of thought which are discussed in Butcher's original text.

The readings, therefore, have the strength of the original. The major strength is the breadth of approach to the workings of the human intelligence. These are certainly not readings in psychometrics. They range widely and include Broadbent's illuminating and provocative address to the American Educational Research Association, Minsky's article on *Artificial Intelligence* and a section from Wallach and Kogan's *Modes of Thinking in Young Children* as well as the more traditionally psychometric writers on both sides of the Atlantic, including Humphreys, McNemar, Eysenck and Vernon. If Cronbach's two disciplines of scientific psychology still persist in isolation, it will be in spite of the efforts of Butcher to bring the two together. It is a pleasant thought that the next generation of students of educational psychology will not feel that the behaviourist and the psychometric traditions are opposed, but will, thanks to the efforts of Butcher, see them as clearly related and complementary.

Inevitably one has reservations. There is, of course, a logic in excluding Guilford's mental bloc from the book but it poses problems. Several of the articles included in the book refer to the " structure of intellect " model and it is hardly fair to Guilford to have his point of view presented solely through the eyes of his critics, especially since there is extensive discussion of this work in the text. Much more important is that the ' building block ' theory of intelligence as contrasted with the ' g ' plan is not represented at all. A lecturer can correct whatever he considers to be the deficiencies of Butcher's text in his lectures but the point of a book of readings is, as the editors point out, that it is difficult for students to have access to journal articles. How then can a lecturer who adopts this book of readings give his students the same direct experience of the point of view of the Thurstones, Guilford or their associates as they get of Burt and Spearman ? A general deficiency of this kind is more important than cavilling at the inclusion of one representative of a point of view rather than another. Surely room could have been found by leaving out an article, like that of Warburton and his associates, which is of rather specialised interest.

Each reader will find included in this collection articles which have been of significance in his own intellectual development, and others which he personally has found peripheral. That is inevitable. Only one's own personal collection of readings would be completely satisfactory, and this is my criticism, not of this particular book, but of the publisher and the whole enterprise.

We are long past the stage where it is necessary to produce a single book of readings—even one as good as this. Publishers here should now be willing to produce what we have seen for some years across the Atlantic—a set of readings tailored to meet the need of a particular course.

If the publishers had been more flexible they could have printed separately two or three times as many articles as are included in this book, allowed each lecturer to make his own choice from this extended list and assembled the articles in loose leaf binders. In this way each lecturer could select readings to meet the needs of his own students and to compensate for the deficiencies of his own library. Equally important, it is possible in this way to avoid the inevitable deficiency of a book of readings—recent contributions are not included. This book will be used by students first in 1973 and then for many years after one expects, yet the most recent article included is one published in 1970 and that to my mind a technical article of peripheral interest to the general student. The loose leaf format makes it possible to include the more recent material that lecturers refer to in their lectures.

We do, of course, need the hard work of editors like Butcher and Lomax to select the initial list of articles to be made available, but we can reasonably expect our publishers to make it possible for each lecturer to choose the articles that are most important in his circumstances and to include the material less than five years old.

Until our publishers can be shaken out of their lethargy we must be grateful to Butcher and Lomax for a thoughtful, wide-ranging selection from the mass of literature on human intelligence produced in the last decade or so.

BRIAN DOCKRELL.

CHEIN, I. (1972). *The Science of Behaviour and the Image of Man.* London Tavistock, pp. xii+347, £3·75.

Here is yet another attack on the orthodox psychology that is broadly associated with American behaviourism. The author, a Professor of Psychology at New York University, is passionately concerned to reject the ' image of man ' projected by such psychology—that man is a robot, " a complicatedly constructed and programmed robot, perhaps, but a robot nevertheless." Instead, he argues in favour of a sharply contrasting image, " that of Man as an active, responsible agent, not simply a helpless, powerless reagent." So this is a book not intended to establish psychological facts. Rather, it argues for philosophical foundations for psychology which are radically different from those provided by positivism and behaviourism.

It is an ambitious and wide-ranging book. It is, therefore, difficult to summarise its contents in a brief review. But, for example, the author endeavours to define, clarify and inter-relate such important concepts for psychology as ' behaviour,' ' mind,' ' body ' and ' personality,' and for the philosophy of science as ' definition,' ' reality,' ' truth ' and ' verity.' In the process, it soon becomes apparent that he is highly critical of—not to say contemptuous of—many of the philosophical pillars by which behaviourism is supported. Thus, operational definitions, mechanistic causation, the stimulus-response paradigm and physical reductionism are all caustically condemned. Indeed, in his final chapter, the writer launches a sustained and detailed attack upon experimentation in psychology, arguing that " in principle, experimental method cannot establish truth, that is, confirm disconfirmable propositions." The notion, implicitly held by many psychologists, that data collection under controlled experimental conditions for later statistical analysis is the only really intellectually respectable way of advancing psychological knowledge is one which this author finds wholly unacceptable. In fact, he concludes by hoping that one result of his book will be that " those who are so inclined and appropriately gifted will be encouraged to pursue long-range programmes of conceptual analysis, freed from obsessional hounding and badgering to produce premature and inappropriate empirical validation of their work."

There can be no doubt that this is an interesting, unusual and provocative book. Its critique of the positivistic and materialistic foundations on which so much of modern psychology, until at least very recently, has been based is detailed and well developed. Moreover, it is supported throughout by the author's clearly very wide knowledge of the history of both philosophy and psychology as well as of more modern developments in these two fields. But how adequate are the alternative philosophical foundations for psychology proposed by the author? Here, unfortunately, the book is less satisfactory. Despite a gallant and in many ways most interesting last chapter, it is far from clear, at least to this reader, what a scientific psychology based upon ' verity ' rather than ' truth ' would in fact be. How would it be practised and agreed conclusions reached? Or is the whole notion of reaching ' agreed conclusions ' a hangover from our positivistic past? The author's arguments are not helped by the book's style Throughout it is written in a highly personalised way, with an extremely abundant use of the first person and irony, sarcasm and invective not uncommon. Also, the liberal use of cross-references, footnotes, parenthesised remarks, digressions and repetitions constantly distracts the reader's attention from the developing arguments. This is not an easy book to read. Nevertheless, psychologists concerned for the philosophical foundations of their subject will, generally, find the effort worthwhile.

G. W. PILKINGTON.

GRACE, G. R. (1972). *Role Conflict and the Teacher.* London: Routledge and Kegan Paul, pp. 144, £2·00.

What to say about this book? Mr. Grace is a sociologist, and a lecturer in education. He describes the book himself as " some contribution to the sociology of teaching " (p. ix). He takes what he calls " the somewhat unfashionable view " that " the teacher is as important as the child in the educative process." The reviewer has read the book more than twice, browsed through it, examined and checked the figures in the various tables, and now finds it difficult not to use the sociological jargon.

Mr. Grace is reporting the results of two questionnaires completed by a representative volunteer sample of 150 secondary school teachers in a small Midland town, and of interviews with 80 of the same teachers, and a further set of interviews with the heads of the 10 schools.

The questionnaires were devised to provide empirical evidence about the ' role conflicts' inherent in teaching described by Bryan Wilson in a 1962 paper—' The teachers' role: a sociological analysis ' (*Br. J. Sociol.*, XIII (1), pp. 15-32). There were eight questions in each questionnaire, two on each of (1) knowledge of results in teaching; (2) pressures from outside about how to teach and professional status; (3) the demands of career progress against commitment to a particular school; and (4) the teacher as upholder and transmitter of traditional values. These are called, respectively, in order, role diffuseness, role vulnerability, commitment *versus* career orientation and value conflicts.

The two questionnaires were the same, but the teachers were asked to indicate, first, the extent to which they saw these as areas of conflict, and second, the extent to which they had experienced them as serious conflicts in their own careers. The answers were scored on a five-point scale. The results showed that the most important perceived conflict was in commitment *versus* career orientation, and in divergent value orientations, on which two-thirds of the sample scored high. Just under half of the sample scored high on role vulnerability, and about one-third on role diffuseness.

On the experience of role conflicts, the results showed, however, that only about one-third reported experience of conflict over values, 25 per cent reported conflict over role diffuseness and role commitment and 22 per cent on role vulnerability. Mr. Grace finds this discrepancy between perception of, and the experience of conflicts, puzzling, but not so puzzling as the reviewer finds them. Mr. Grace mentions briefly some of the personality variables that have been said to be related to role conflict (p. 39)—for example, emotional sensitivity, flexibility/rigidity, introversion/extraversion—but does not develop this topic. In any case he had no measures of these variables for his sample of teachers. However, he had a number of other variables: men and women teachers; those with more or less than 10 years' experience, and those teaching in secondary modern, bilateral or grammar schools. He seems to have calculated all possible chi-squares between high and low scores divided into these categories. Few of the chi-squared tests were significant. Of the 18 that were significant, 11 were comparisons between secondary modern school teachers and the others, and what is more important is that the secondary modern teachers were showing a significantly higher incidence of experience of role conflict in all four areas.

This was supported by the supplementary interviews, in which some of the secondary modern teachers revealed a considerable amount of bitterness and frustration about their professional status, career prospects and lack of ' visible results ' of their efforts, as well as some worries about conflicting values.

All this amounts, it seems, to evidence that a large proportion of this sample of secondary modern school teachers were not happy in their work—though this is not the conclusion that Mr. Grace draws from the study.

The conclusions he does draw are rather general—that the colleges of education need to prepare their students more fully to cope with changing methods of teaching, and with changing values. Some of his most perceptive comments are confined to the notes on each chapter, which appear after the appendices, on pages 126/139. These notes would have been more useful as part of the text, since their effect usually is to make his points more clearly and sharply.

However, it seems a lot of work to do to arrive at the conclusion that some teachers think there must be ' role conflicts ' in teaching, for other teachers, though not for themselves, and that secondary modern teachers are more worried about their roles than others. Perhaps, since he works in a college of education, Mr. Grace could find out why his students have chosen teaching as a career, and what satisfactions and difficulties they expect to find in the job when they are doing it, and relate these also to some of the personality variables he mentions so briefly.

AGNES CRAWFORD.

KREITLER, H., and KREITLER, S. (1972). *Psychology of the Arts*. Durham, North Carolina: Duke University Press, pp. xiv+514, $13·75.

" The psychology of art embraces two vast problems—the creation of beauty and the enjoyment of beauty, or, in other terms, the psychology of the artist and the psychology of the spectator."* The authors of this book are primarily concerned with the latter problem.

The book is divided into two interrelated parts. In Part I, the first chapter, which serves as an introduction for the whole book, starts with a review of four psychological theories which, in the last 50 years or so, have been used to describe and account for the spectator's experience of art—psychoanalysis, Gestalt theory, behaviourism, and information theory. Each of these theories has weaknesses when applied to the domain of art experience. Consequently, the authors have attempted to construct " a new theory which integrates . . . some of the better-founded hypotheses from the various theories " (p. 12). A basic hypothesis of this new theory is that works of art are capable of producing tensions in the spectator. These tensions can absorb and combine with diffuse residual tensions in the spectator, yet they are specific enough to be resolved through other aspects of the work of art. The resolution of these specific tensions also provides relief for the diffuse tensions with which they have combined and this is attended by pleasure. The remaining chapters in Part I are concerned with testing and demonstrating this tension-relief hypothesis for the so-called formal elements (colours, forms, tones, movements, etc.) in each of the main arts, i.e., painting, music, dance, sculpture and architecture, and literature (poetry and prose).

Part II goes beyond tension and relief to the problems of experiencing the narrative-representational content of the arts. One chapter is devoted to the role of set, feeling-into, and aesthetic distance in experiencing art. Further chapters deal with sublimation, multi-leveledness, abstraction, symbolisation, and the contribution of art to the cognitive orientation of the spectator. These chapters require concentrated effort to follow because much of the writing is at a high level of abstraction. There is a good deal of speculation enmeshed in the authors' arguments but the speculation is not without interest. In the final chapter, an epilogue, the authors bring the two sections of the book together and suggest some new questions for further research. The problem of devising a detailed blueprint for concrete empirical work is left, significantly, to the reader.

One of the major assets of this book is its comprehensive coverage. Ideas, research findings and theoretical formulations from many branches of psychology and aesthetics are skilfully woven by the authors into the fabric of the whole. The 60-page reference section starts with Spinoza's *Ethics, Part III* (1675) and spans the years right up to the present.

The book is illustrated with 19 line drawings, 10 black-and-white plates and 7 colour plates, and contains only a handful of misprints: " *82* per cent even incorrectly guessed that the computer design was created by Mondrian " (p. 96); "Arousal and *information* " (p. 398); " Sciences de l'Art, 1965, 3, 9-23 " (p. 398); " Individual *difference* in *judgement* of the beauty of simple forms " (p. 446); " Philosophische Studien, *1893* " (p. 451). Information which mainly concerns the expert is relegated to 25 pages of readily accessible notes and there are separate name and subject indexes. A glossary would have been a useful addition.

Overall the book is worthwhile, and should be recommended to those interested in the psychology of art. It is unfortunate that the price will deter many from buying it.

In his book, *The Experimental Psychology of Beauty*, Valentine (1962) opined that " it would be extremely presumptuous for any one man . . . to attempt . . . a general psychology of all the main arts " (p. 5). It might be added that it is equally presumptuous for any one man to review such an attempt.

GORDON RAE.

* BURT, C., The psychology of art. In BURT, C. (Ed.) (1933). *How the Mind Works.* London: Allen and Unwin.

PICKARD, P. M. (1971). *Psychology of Developing Children.* London: Longmans, pp. 341, £2·50.

A book on child development by a British author, containing numerous references to work published in British journals, can hardly be other than welcome. For this reason, if no other, Miss Pickard's recent volume will be sure of a place on the reading lists of students in child development courses in this country.

The orientation is towards the needs of students of education and teachers, the content comprising a mixture of fact and theory. Being well aware of the anxiety and suspicion with which many teachers view research, she takes the trouble to present in simple fashion details of selected researches, leading into this through the use and misuse of words and the differences in their usage when employed by psychologists and lay people, and thence to problems of communicating research findings in learned journals. The hints she gives on reading, note taking and filing of information may not be needed by the university undergraduate student in psychology, but they could be very valuable to those in the field of education whether training or practising as teachers, a fact with which Miss Pickard's own experience has undoubtedly made her very familiar.

Her material is arranged around five stages in the child's development—birth to 15 months, to 2½ years, to 5 years, from 5 to 8 and from 9 to 12 years. In each of these five parts she has devoted a section to aspects of general development, followed by a section on language, including speech and reading when appropriate, in the course of which she adheres closely to the chronological limits she has set herself. It is in the sections which follow these two, in every part, that treatment by stages of development rather than by area of development falls down. Thus, in the section dealing with birth to 15 months, more than half the space is devoted to an exposition of heredity and environment, without much direct relevance to infant development, while in stage 15 months to 2½ years the third section is set aside for the work of Piaget, in which abruptly abandoning the notion of age, she presents some brief discussion on the development of reasoning in children up to the age of formal thinking.

In the first two parts there is an emphasis on speech, language and reasoning rather to the exclusion of other areas, although the use of projection and other mechanisms is mentioned in connection with play and story telling. When a section headed personality does occur, this is not until part 4 and it consists of a quite detailed and very useful summary of methods of assessing personality by ratings, questionnaires and projective tests. The method of ratings is given the biggest coverage and teachers would find this of value, since they not infrequently find themselves in situations which demand it. Although this section is located in the part dealing with 5–8-year-olds, the majority of researches cited relate to children of later junior school age. Learning is discussed, but in a rather theoretical way : fortunately, this is counterbalanced by useful sections on reading and mathematics. It is not, however, until after a discussion of general development in the part dealing with 8–12-year-olds that social relationships and the developmental of morality come up for treatment. Following that, the topic approach is used for such matters as tests of intelligence and attainment, gifted and educationally subnormal children, child guidance, secondary education and the role of the teacher.

The book, indeed, does seem to fall half-way between a presentation of developing processes in children as they mature from birth to 12 years of age and a theoretical presentation of topics like heredity, learning, tests and testing, and in a way it emerges as a kind of uneasy compromise. In spite of this, however, there is such a wealth of material that it would be a pity to miss reading it. For students, however, it would almost have to be accompanied by seminars, lectures and discussions to achieve maximum value.

GERTRUDE KEIR.

RHODES, W. C., and TRACY, M. L. (Eds.) (1972). *A Study of Child Variance.* Ann Arbor, Michigan : University of Michigan, pp. 623, $1·25.

This book (if such it can be called) consists of a set of papers prepared by research assistants as basic material for the first phase of an extended project concerned with emotional disturbance and supported by grants from the US Office of Education, Department of Health, Education and Welfare.

The participants are exploring six schools of thought: psycho-dynamic theories, learning theory, ecological theory, biophysical theory, sociological theory and counter-theory. The preparation and discussion of these topics in relation to emotional disturbance have brought together theoreticians, teacher trainers and graduate students. Conferences and workshops have been held. The whole is based on the University of Michigan but the project is nation-wide and involves every university offering a graduate level programme for training teachers of the emotionally disturbed. In all, a very large number of people are taking part—67 of the most important contributors (including many well-known names) being specially acknowledged in the preface.

Introductory and concluding overviews by the project director, William C. Rhodes, present the purpose and achievement of the work so far. Confronted with a "profusion of data, facts and concepts" in the field of emotional disturbance, Rhodes insists that the various models are not presented as competitive explanatory systems. Rather, the emerging impression is that they constitute "different facets of a pervasive community phenomenon." This, though multi-dimensional, "might be seen as having a unity of its own which underlies all the psychological pain of societies."

The body of the report is taken up with outlines of the current interpretations of emotional disturbance adopted by the six disciplines. Each section has its own author or authors and offers the reader essay-like statements, most of them with plentiful references, quotations and bibliographies. These provide clear summaries and some make considerable claims for their particular model Exceptionally, the author of the ecological chapter (Lynne Feagans), however, admits that present (ecological) theory in this area "is a combination of hypotheses, research, and attitudes." This frankness actually enhances the 'insights' derived from one of the volume's most interesting and best documented sections. In contrast, the 70 or so pages devoted to counter-theory contributes very little. Though lively and polemical, there is too scant backing and coherence here, faults which the rest of the writers creditably avoid.

Nothing if not thorough, the participants quote a 'feedback' (Appendix 2) from about 225 teacher trainers who received the papers under review prior to publication. 51 per cent gave positive statements about their value, 44 per cent were neutral, and 5 per cent were negative. The latter appraisal has considerable justification. The whole book, in fact, illustrates the uselessness of blanket terms. Nowhere is the expression 'emotional disturbance' strictly defined. Nowhere is any distinction made between neurotic and psychotic states. Most papers actually touch on examples of both and draw illustrations to suit their particular point of view from such various conditions as autism, phenylketonuria, deviant addictions, school misbehaviour, delinquency, schizophrenia and depression. Specific childhood variance gets uneven amounts of attention.

Obviously a lot of people have kept themselves very busy to produce the 625 pages of this study and probably each has profited from the activity and has clarified his own thinking in the process, but it is doubtful if its wider publication serves any useful purpose.

OLIVE C. SAMPSON.

SLUCKIN, W. (1972). *Imprinting and Early Learning*. (2nd edit.) London: Methuen, pp. 180, cloth £2, paper £1.

This book has deservedly become an established source-book on imprinting which it reviews with accuracy and insight. It starts with an excellent and exciting chapter on the origins and development of the imprinting concept. The following chapter on general concepts and terms is really a discussion that could be better placed later in the book, where indeed much of the material is referred to again. The next five chapters survey and analyse the work on imprinting in terms of approach and following responses, the growth of attachments (two chapters), the sensitive period, and fear and anxiety. The relevant studies are shrewdly chosen and their essence presented with an unusual degree of reliability.. The next two chapters are discursive. One is a short but interesting introduction to work on early learning. The other contains an admirably concise and clear treatment of learning, a somewhat less clear consideration of imprinting and conditioning, and a preliminary exposition of exposure learning. It ends with a view of imprinting-like behaviour, which could involve exposure learning, in animals and man ; a subject which is taken up again in the new chapters that follow.

The first of these is an avowedly selective but balanced review of imprinting work subsequent to the first edition. The next chapter briefly reviews studies of the effects of early experience but does not attempt to distinguish between enrichment and deprivation or between early infantile and prolonged juvenile experience. The last chapter is on the application of the imprinting concept to human attachment behaviour and includes some excellent and considered material. The chapter ends the book with the conclusion that imprinting, attachment, and exposure learning do not refer to any distinctive learning processes, but are merely convenient terms for some behavioural consequences of experience that do not fit conditioning models. The reader should form his own conclusion on the basis of the evidence and arguments contained in the book concerning the distinctive nature of these processes. It could be that the author's conclusion results from trying to accommodate too much of the supposed evidence and too many of the viewpoints and claims in the literature. For example, at one point he appears to accept imprinting as a single process of acquiring a species partner (social and sexual), yet later he uses the concept of sexual imprinting. This is a major issue among imprinting workers and the author's final position is not clear.

Similarly, he hesitates to accept claims of imprinting in mammals because of the possibilities for reinforcement, but accepts similar claims for altricial birds where the same possibilities occur. More severe criticism and weighting of the experimental data might help resolve these issues and would better reflect the very uneven quality of imprinting papers. The author is kind to the researchers, but the reader might benefit from their harsher treatment. Nonetheless, this book is full of reliable information, stimulating discussion and reasonable conclusions and should be read by anyone interested in imprinting and attachment behaviour.

ERIC A. SALZEN.

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AGE STANDARDISATION AND SEASONAL EFFECTS IN MENTAL TESTING

By H. GOLDSTEIN and K. FOGELMAN
(*National Children's Bureau, 8 Wakley Street, London, ECIV, 7QE*)

Summary. It is pointed out that there are two distinct types of age standardisations for tests of school attainment. One is concerned with allowing for differences in age between children tested at the same time, and the other is concerned with allowing for average changes in test scores with time of year. Standardisation procedures do not normally take account of this distinction. It is also shown that there is no increase in attainment scores between April and July among 11-year-olds in the last year of primary school. This ' seasonal ' effect creates further difficulties in providing satisfactory age standardisations and it is suggested that full age-time standardisations should be carried out by selecting standardising samples over whole age ranges at different times of year.

INTRODUCTION

Between 1962 and 1972 the National Foundation for Educational Research increased its sales to local authorities of standardised ability and attainment tests from 2 to 3·5 million.

Whatever the reasons for this increase, it does indicate an increasing use of, and presumably reliance upon, such tests. Whether these tests are used for research purposes or to allocate individual children to schools or groups, it is clearly important that the standardisation of the tests should be soundly based. The purpose of the present article is to point out that, in two respects, present standardisation procedures may give rise to misleading results.

Since any one test may be applied to children in an age range within which the average score changes, an adjustment for age is necessary if the scores obtained by children of different ages are to be compared. In addition to such an ' age standardisation ' it is common to ' normalise ' the raw scores by transforming them to give a distribution with a mean of 100 and a standard deviation of 15. For present purposes, however, we are only concerned with the age standardisation, and the use of a normalising transformation will not affect our arguments.

The procedure which is usually followed in constructing norms for a test involves the administration of the test to a large representative sample of children at a given point in time (usually over a period of a few weeks). The change in average score with age is then estimated from this sample, and it is this estimate which is subsequently used to adjust or standardise for age.

This procedure, however, is inadequate since the test score will depend not only on the *relative ages* of a population of children, that is the differences in age at a given point in time, but also on the *time during the school year* when testing takes place. This is shown formally in the appendix using a mathematical model, and may be illustrated as follows.

If we consider a child tested at different times during the school year (the discussion will be restricted to one school year) then his score will be expected to change with time. Suppose that the expected or average change for all children is x score points per month. Such change will be referred to as ' longitudinal ' change and if x is known it may be used to ' adjust ' children's scores to a common time of year—a ' longitudinal ' adjustment.

As has been pointed out, however, in the standardisation procedure which is usually adopted it is not x which is estimated but y, say, where y is the average change in score with age for children of different ages measured at a single point in time, a ' cross-sectional ' adjustment. Although both the adjustment for age and that for time during the school year are measured in the same units, they are logically distinct. (In practice, standardising samples often span more than one year group so that ' longitudinal ' changes are also included and the final adjustment will, therefore, be an average of the ' longitudinal ' and ' cross-sectional ' changes.)

It is reasonable to suppose that average scores on attainment tests will be closely linked to the teaching programme. For example, towards the end of primary schooling all the children in a class or year group will have been exposed to very nearly the same amount of teaching and as a result the average test score ***might*** be expected to vary more with calendar month than with month of relative age difference between children, that is, we should expect x to be greater than y. One result of this would be that children tested early during a school year would tend to be penalised. However, the next section demonstrates that x does not remain constant throughout the school year and this should be taken into account when undertaking standardisation. It may also be true that the value of y depends on time of year.

The implications of this are clear: namely, that purely ' cross-sectional ' age standardisation will, in some circumstances, be inadequate and that ideally what is needed is a standardisation which also takes account of the change in score as children progress through the school year; what might be termed an ' age-time ' standardisation. We now discuss the way in which the average test score actually does change during the school year.

NON-LINEAR AGE TRENDS AND SEASONAL EFFECTS

The equations presented in the appendix assume a linear relationship between test score, age and time. On the face of it, it seems reasonable to assume that the later in the school year a child is tested the greater will be his/her knowledge and, therefore, the greater will be the score obtained on an appropriate test.

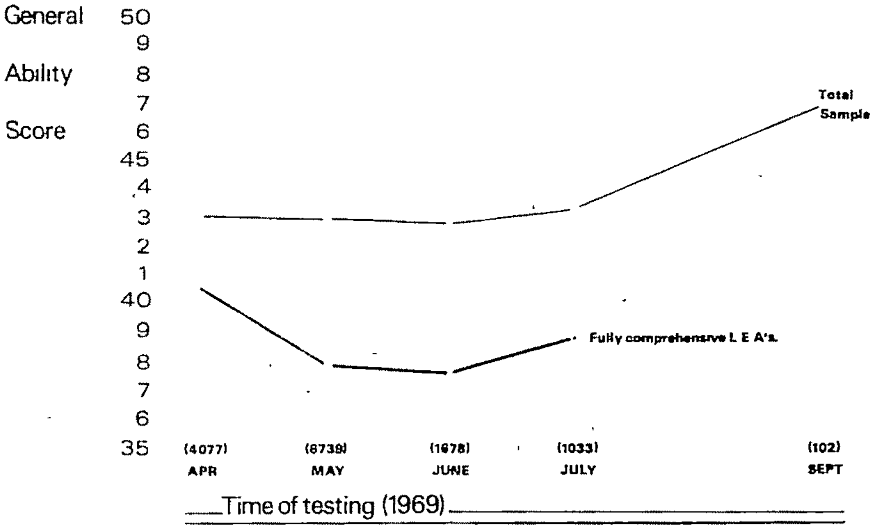
However, data from the National Child Development Study (Davie *et al.*, 1972) do not support this.

As part of this study, 13,659 children born during the same week, namely, 3rd—9th March, 1958, were given tests of general ability, reading and mathematics between April and September, 1969. The general ability test was provided by the NFER and consisted of verbal and non-verbal items. The reading test was a parallel test to the Watts-Vernon. The mathematics test was a modified version of the Vernon graded arithmetic test. Since all these children are born in the same week there are no ' cross-sectional ' age effects. Figure 1 shows the mean general ability score (out of a total of 80) by month of testing. Similar results were found for the other two tests.

FIGURE 1

National Child Development Study : Mean General Ability by Month of Testing.

(Numbers of children in parentheses.)



During the three months of the Summer term from April to July there is a striking absence of an increasing trend, although according to available norms (NFER, 1972) a mean increase of about 1·6 score points would have been expected. This implies that if an age standardisation based on an expected increase is carried out, in contrast to what would be expected on the basis of the argument in the preceding section, those children tested *later* will tend to be penalised. Consider, for example, a child who is actually at the 50th centile with a score of 43·2 measured in July. Assuming an average gain of 1·6 points between April and July, and if April were chosen as the base month for test standardisation, then such a child would actually be classified as being at the 46th centile. In addition it should be noted that the estimate of 1·6 points is based on a 'cross-sectional' age standardisation and not as required on a longitudinal standardisation. For an individual child, such a misclassification is unlikely to lead to serious consequences. On the other hand, an average misclassification of this order may be important when applied to large groups of children, such as all those in one school. Furthermore, if the mean scores before April also do not increase linearly with time, an adjustment over a longer period than three months might lead to greater errors of misclassification than that given in this example.

It should be recognised, however, that in practice the biases which may be introduced into the standardisation of tests for national use by variations between local education authorities, regions, etc., will normally be larger than biases arising from any failure to take account of the effects described above. On the other hand, *within* one school or local authority, the former biases will be constant and biases arising from seasonal and 'longitudinal' effects could become important.

There is also evidence from studies in the United States which tend to confirm the present findings. For example, Beggs and Hieronymus (1968) show a smaller than average increase in score on tests of arithmetic and language between May and September, for children in the 3rd–6th grades.

Several explanations for the present results are possible.

First, it is possible that the time of testing the children in this sample is associated with other factors influencing test scores. The dates of testing depended basically on the administrative convenience for the schools and local education authorities concerned. The possibility exists, therefore, that, say, the most co-operative and enthusiastic schools and local authorities, where the children would be tested earlier, would also tend to contain the most able children. It has not been possible to test this directly, but the date of testing has been related to the child's social class, the size and type of school, and the region of the country. None of these factors was associated with the date of testing.

A second possibility is that these figures reflect an actual lack of development during this period. To put it bluntly, perhaps children do not learn anything between April and July of their last year of primary schooling. Undoubtedly, in many schools there is a lessening of the academic demands made on their pupils towards the end of the school year, and this may be more marked in the year in which the pupils are about to change schools. (Not all those tested were about to change school. 10 per cent were in Scottish schools and, therefore, not due to transfer to secondary schools until the following year. Also 4 per cent were in independent schools and many of these would stay until the age of 13). However, it seems extremely unlikely that such an effect would begin to appear so early in the school year as to account for a lack of increase in score between April and May. Furthermore, the large increase between July and September would remain to be explained. This increase is more easily reconcilable with a third explanation. It may be that the skills which the tests are designed to measure continue to develop during this period, but the motivation to display them in the testing situation decreases. Perhaps the desire to do well on such tests fades as the end of the year approaches. This seems slightly more plausible than the previous explanation but it still does not seem adequate to explain the appearance of the levelling-off so early in the school year.

Each of the explanations so far considered has assumed that scores are in some way 'artificially' decreased towards the end of the period considered. There is, of course, a second possibility—that scores have been 'artificially' increased at the beginning of the period. In areas where tests are still administered as part of the selection procedure, this is usally done in February or March. For most children this will have been preceded by practice on tests of attainment and general ability similar to those used in the Study. This practice will, to a limited extent, have raised scores on the tests (see Yates, 1953, and Vernon, 1954). However, this effect will decrease once the practice ceases and this would lead to the results reported here.

The bold line in Figure 1 represents those children (475 in all) in local authorities which had fully comprehensive education and where, therefore, we can be reasonably sure that the children did not take an '11+' examination. It can be seen that the same pattern persists. It would be wrong to assume, however, that these children had not experienced any tests of this kind, since even within a comprehensive system it is common for such tests to be used at the time of transfer to secondary schools. To test this hypothesis properly we should need to know, for each child, the extent of his familiarity with tests and testing situations. This information, unfortunately, we do not have.

CONCLUSIONS

Whatever may be the explanation, the data reported in this paper offer strong evidence for a seasonal effect with children of this age on the tests used. Given the diversity of tests (general ability, reading and mathematics) it seems likely that this ' seasonal ' pattern would be found in many tests of attainment. Further research would be necessary to show whether similar results would appear for children of different ages.

There are important implications here for the production and use of normative data for tests of attainment. Present procedures assume not only that (cross-sectional) age gains are independent of the date of testing, but that age gains based on such ' cross-sectional ' data can also be applied ' longitudinally.' We have tried to indicate that these assumptions are questionable.

It follows that a single age adjustment is inadequate and that standardisation procedures should, where possible, take account of the time of year of testing as well as the age of the child at that time. The age-time relationship for any given test would need to be determined by selecting standardising samples over the whole age range at different times of year.

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APPENDIX

It is convenient to consider a time span restricted to one year corresponding to the school year. During this year the school year group (e.g., children in the last year of junior school) will be taken as defining the population. Thus, at any one point in time the age range of the children will also (normally) be one year.

Suppose that the relationship between test score and age for an individual child is linear, i.e.,

$$y = \alpha + \beta x \qquad (1)$$

Since the rate of change of score with age will vary from child to child, β will be a random variable over the population of children. In addition, if children are classified by other factors, for example by sex, or by region of the country, then it will be necessary to modify equation (1) by introducing further terms to describe these classifications. The particular classification of interest in the present paper is the birth date of the child or, equivalently, the age of the child at a given point in time.

Suppose that equation (1) holds except that α depends on birth date, or for convenience, the age of the child at the beginning of the school year (t), and suppose also that this relationship is linear. This gives

$$y=\alpha^1+\beta^1{}_1 t+\beta x \qquad (2)$$

Here $\beta^1{}_1$ is a fixed coefficient but since there is variability among children with the same birth date, α^1 will be a random variable.

We may write equation (2) for the i^th^ child, as

$$y_i=b_{0i}+\beta_1 x_{1i}+b_{2i} x_{2i} \qquad (3)$$

where

b_{0i} is a random coefficient $E(b_{0i})=\beta_0$
b_{2i} is a random coefficient $E(b_{2i})=\beta_2$
β_1 is a fixed coefficient$=\beta^1{}_1+\beta_2$
x_{1i} is the difference between the age of the ith child
and the mean age for the year group at a given point in time
$(-0{\cdot}5<x_{1i}<0{\cdot}5)$.
$x_{2i}=x-x_{1i}$ i.e., the mean age of the year group at the time of testing, or simply calendar time of year measured from the start of the school year.
$\mathrm{Var}\,(b_{0i})=\alpha_{00}$ $\mathrm{Var}\,(b_{2i})=\alpha_{11}$, $\mathrm{cov}\,(b_{0i}, b_{2i})=\alpha_{01}$

Assume also that b_{0i}, b_{2i} are normally distributed. Equation (3) is a regression model of the second kind as discussed by Nelder (1968) and uses Nelder's notation.

The parameters β_1, β_2 represent the average change of score with relative age and with time of year, respectively. For a given value of x_{2i}, i e., at a fixed time of year, the score will depend on x_{1i} only and β_1 may be used to ' adjust ' an individual's score to a common value. This is referred to as ' cross-sectional ' adjustment and is the method by which attainment test scores are commonly standardised, as explained in the main text. It is not, however, appropriate to use β_1 for adjusting the scores of children measured at different points in time, since the score will then depend also on β_2. For a given value of x_{1i}, i.e., children of the same relative age measured at different points in time, β_2 is used for adjustment. This is referred to as ' longitudinal ' adjustment. It follows that where age standardisation is required over a time period for children with different relative ages, knowledge of both the longitudinal and cross-sectional adjustments is necessary and a standardising sample should be adequate to estimate the size and nature of these and possible interactions between them. The linearity assumptions should also be critically examined in view of the ' seasonal ' effects described in the main text

Example.

A sample of 239 children, 160 in the last year of primary school and 79 in the first year of secondary school, were given a mathematics test which had been used for 11-year-olds in the National Child Development Study. These school classes were selected with the intention of providing representative samples of their age groups, and all the children were tested at the same time (end of September, 1972).

Equation (3) is appropriate since there are both ' cross-sectional ' (within year groups) and ' longitudinal ' (between year groups) effects within the sample. However, since the longitudinal effect is based on only 2 times, the model (3) is under-identified, since it turns out that there is one more parameter to be estimated than there are estimating equations, and an assumption must be made about the values of the variances and covariance. One assumption which satisfies the likelihood equations is to set $\alpha_{11}=0$, which gives (3) as the ordinary fixed effects model. Hence the results in Table 1 are, for simplicity, presented in terms of a fixed effects model.

TABLE 1

REGRESSION COEFFICIENTS AND ANALYSIS OF VARIANCE TABLE.

x_{2i} is measured from the start of the last year of primary school (mean age of class = 10·5 years).

Coefficient	Fitted Value	Standard error	Mean square ratio
β_0	15·9		
β_1	1·8	1·5	1·3
β_2	4·7	1·1	18·4*
Total variance = 66·3 Residual variance = 61·3			

Significance levels: * $P < \cdot 001$, otherwise $\cdot 05 < P$.

It will be seen from Table 1 that the estimate of β_2 (4·7) is greater than that of β_1 (1·8) which is not statistically significant. However, the difference $\beta_2 - \beta_1$ is not significantly different from zero (χ^2 (1 df) = 2·1) so that this small sample does not provide sufficient evidence on which to make a reliable inference concerning this difference. Since the estimate of β_2 is based on two occasions a year apart, it represents an average 'longitudinal' effect, and as pointed out earlier there are 'seasonal' variations during the school year.

SITUATIONAL VARIATION IN LEVEL OF MORAL JUDGMENT

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Summary. Reports of research on Kohlberg's stages of moral judgment have assumed that level is general across situations and that a single major factor underlies responses. A partial replication of Kohlberg's research indicated significant variation from situation to situation in the responses of 40 12-year-old boys and 23 university students to the moral judgment interview. A factor analysis indicated two factors underlying responses to the interview · an empathic or role-taking factor and one involving concepts of social rules and structures. The results emphasise the need for more detailed descriptions of moral development and more detailed scoring systems.

INTRODUCTION

Kohlberg (1958, 1970) has described three levels of moral judgment each of which may be sub-divided into two stages giving, in all, six developmental stages, namely:

Preconventional Level.
Stage 1. Obedience and punishment orientation.
Stage 2. Naively egotistic orientation.

Conventional Level.
Stage 3. Good boy orientation.
Stage 4. Authority and social order maintaining orientation.

Post-conventional or Autonomous Level.
Stage 5. Contractual legalistic orientation.
Stage 6. Conscience or principle orientation.

A subject's stage of development is determined by noting and assessing his responses to nine hypothetical dilemmas. Research stemming from Kohlberg's original (1958) description has followed him in describing subjects as being at one particular stage, e.g., stage 3, and in some cases (e.g., Blatt, 1969) subjects have been discarded because they could not be confidently assigned to one or another of the six stages.

To describe a subject as being at one particular stage assumes that the same dominant stage of moral judgment is used on all nine of the dilemma situations in the interview. This assumption is made in reports by other investigators and made and defended by Kohlberg in his original (1958) report. The assumption that only one stage of moral judgment is used in discussing a particular situation is not made and would probably be untenable. A subject typically shows some ' stage mixture ' in his spontaneous usage as well as one modal stage.

One of the methods of scoring, Global Scoring, assigns a single stage score based on the stage predominantly used, i.e., a subject who in the whole interview used stage 2 reasoning 70 per cent of the time and stage 1 reasoning 30 per cent of the time is designated stage 2. A second method of scoring involves the computation of a weighted Moral Maturity Score (MMS) which is derived by multiplying the ordinal number of a stage by the percentage of use of that stage and summing the products. By this method the subject mentioned would be given a MMS of 170. Exclusive use of stage 2 reasoning would have earned him a MMS of 200. It can be seen that the MMS is more sensitive to the use of more than one stage of moral judgment than is a Global Score.

It is assumed then that while a subject may use more than one type of moral reasoning in discussing a situation, he will typically use one type much more than the others. It is also assumed that the dominant type used on all situations is the same, i.e., that a subject's level of moral maturity is the same from situation to situation. Kohlberg (1958) argues that moral judgment level is quite general across situations and supports this claim by pointing to inter-correlations among Global Scores on all nine situations. Global Scores on one situation were highly correlated with scores on the others, indicating, Kohlberg argues, that moral judgment level remains the same from situation to situation. In fact, these inter-correlations indicate only that subjects tend to maintain the same ordering from situation to situation. They do not necessarily show that absolute level is the same.

Kohlberg also argues (Kohlberg, 1958) for the generality of moral judgment level across situations by pointing to the results of a factor analysis of these intercorrelations. This analysis indicated that one major factor was related to responses on all nine situations. Kohlberg discounts a second factor as being non-significant by the criterion that less than half of the loadings on the second factor are twice as great as the standard error of the loading. By this criterion, however, the second factor misses attaining significance by only a narrow margin.

In view of these considerations it was felt that the matter of variation from situation to situation within the standard Kohlberg interview was still an open question. If such variation were found it would seem to represent what Piaget terms a horizontal decalage, i.e., a situation in which there is a lag between the application of a set of operations and concepts to one content and their application to another. The existence and precise location of these lags helps, in Piagetian theory, to illuminate the development of cognitive stages. Piaget's (1941) discussion of observed horizontal decalages in the attainment of conservation of quantity indicates, for example, that the attainment of the conservation of weight is logically prior to the conservation of volume as well as being observably prior.

The concept of horizontal decalage is used in various ways by those who have further investigated Kohlberg's theory. Rest (1968) and Rest, Turiel and Kohlberg (1969) use the term to label an observed hierarchy of preference, comprehension, assimilation, and usage in the attainment of a given stage of moral judgment. A subject tends to prefer a stage before he comprehends it, to comprehend it before he assimilates it and so on. One's decision as to whether a subject has attained a given stage depends then on whether the criterion is spontaneous usage, preference, comprehension, or assimilation. "A decalage explanation is a theoretical explanation of method variance " (Rest, 1968, p. 110).

Rest (1968, p. 55) also uses the term to describe an observed difference in general level from one situation to another, remarking that subjects as a whole tended to get higher scores on situation VI than on situation III. While at variance with the use of the term noted above this use is fundamentally in accord with that of Turiel (1969) who uses it to mean stage mixture. "Some of the the variation can be explained by Piaget's concept of ' decalage ' . . . a child can conceptualise some issues at a higher level than others " (Turiel, 1969, p. 115).

The dilemmas are not pure measures of a single aspect of morality and presumably stage mixture in responses to a single situation is occasioned by the presence of different aspects of morality within that situation, just as differences in profiles of stage usage, and therefore, in MMS, might be occasioned by differences in the sets of aspects dealt with in different situations.

The present study was undertaken to test the hypotheses
(*a*) that MMS differs significantly from situation to situation,
(*b*) that Limit Scores (LS), which are simply a record of the highest stage of reasoning used on a situation, do not differ significantly from situation to situation, and
(*c*) that more than one factor underlies performance on the moral judgment interview, i.e., that Kohlberg's finding of a single factor will not be replicated.

METHOD

Subjects.

The sample consisted of 63 subjects, 40 12-year-old boys chosen at random from two Christchurch intermediate schools and 23 second-year students of education at the University of Canterbury, (six men and 17 women). ACER Intermediate D IQs of the boys ranged from 90 to 130 with a mean of 110 and a standard deviation of 8·8 points. All of these subjects were aged between 12 years 0 months and 12 years 11 months at the time of the study. The students' ages ranged from 19 years 0 months to 27 years 8 months with a mean of 21 years 9 months and a standard deviation of 2 years 4 months.

Instruments.

The ACER Intermediate D test, devised by the Australian Council for Educational Research, is a conventional paper and pencil measure of general ability. IQs were obtained from the schools' records of tests routinely administered two years before the study began.

The main instrument used was Kohlberg's moral judgment interview which consists of nine hypothetical dilemmas in which someone is faced with a moral choice, e.g., whether or not to steal to save a life. Each situation is read to the subject and discussed with him and he is asked what the character in the story should do and why he should do it. Kohlberg (1958) provides a scoring manual by means of which the reasons a subject gives for choosing one course of action over another are assigned to developmental stages. Ten complete transcripts of interviews were chosen at random and independently scored by two raters who assigned stage numbers to each of the statements made by the subjects. The percentage of agreement on stage was calculated for each transcript and found to range from 59 per cent to 85 per cent with a median of 75 per cent. Percentages of agreement on level ranged from 70 per cent to 92 per cent with a median of 85 per cent. MMS were calculated for each of the nine situations in each transcript and the product moment correlation coefficient between these 90 pairs of scores was found to be ·699. This was felt to compare favourably with other investigations of the reliability of the scoring system.

Procedures.

The university students responded to a group form of the interview in which each of the nine situations was read to the group and students wrote their answers down on prepared forms. Each of the boys was interviewed individually during school hours using all nine of the situations. These interviews were tape-recorded and verbatim transcripts of them made. The interviews lasted for at least an hour each and in some cases took as long as an hour-and-a-half. Data gathering took, in all, five weeks.

When all protocols had been completed one copy of each was cut up into nine booklets, each of which contained a subject's responses to one of the situations. These booklets were labelled only with numbers drawn at random and the code numbers were noted elsewhere against subjects' names. When all the booklets had been prepared they were shuffled and scoring began. All of one situation was scored, then all of another and so on until scoring was completed. MMS were calculated and only then were the booklets re-grouped into complete protocols and the scores tabulated. Limit Scores were recorded by noting for each booklet the highest stage score assigned.

RESULTS

Mean MMS for the 12-year-olds on the nine situations are shown in Table 1.

TABLE 1

Mean MMS and SD for 12-year-old Group and Full Sample

	Situation								
Group	I	II	VII	III	IV	VIII	V	VI	IX
12 years									
M	278·5	244·7	274·6	236·3	208·5	277·3	288·5	228·9	245·7
SD	41·6	71·9	73·6	58·8	70·4	61·4	59·2	68·8	60·3
Full sample :									
M	318·9	287·9	307·3	269·9	243·8	306·9	312·3	250·9	275·5
SD	73·1	102·4	82·2	71·9	100·7	73·6	82·9	73·9	77·9

An analysis of variance indicated a significant difference between situations in the scores of the 12-year-olds (F=7·15, df=8/351, P<·01). LS proved to be no more stable from situation to situation than MMS. Intercorrelations of MMS on the various situations ranged from ·00 to ·33 with a median of ·14. Only one of these correlations was significant at the ·05 level. Intercorrelations of LS on the nine situations ranged from ·00 to ·40 with a median of ·10. Again only one of these was significant at the ·05 level. LS and MMS on the same situation were, in fact, highly related and the correlations between them ranged from ·64 on situation IX to ·79 on situation IV with a median of ·73.

In view of the low correlations between MMS on the various situations it was apparent that no general factor would be seen as a result of a factor analysis of the scores of this group. In view of the age homogeneity of the group it was also more likely that the high correlations seen in Kohlberg's study would not be replicated. The full sample constitutes a group more nearly approximating Kohlberg's in age range. The Kohlberg (1958) sample consisted of boys aged from 10 to 16 years. The full sample of boys and university students in the present study ranged from 12 to 27 years in age. The mean MMS of the full sample are also shown in Table 1. An analysis of variance in the scores of the full sample again showed a significant difference between situations (F=6·95, df=8/558, P<·01).

Intercorrelations between MMS on the nine situations for this full sample ranged from ·05 to ·56 with a median of ·37. Thirty-one of the 36 correlations were significant at the ·05 level. A similar pattern was seen in the intercorrelations of LS which ranged from ·09 to ·53 with a median of ·32. Twenty-one of these correlations were significant at the ·05 level. MMS and LS were, not surprisingly, highly related and correlations between them on single situations ranged from ·64 to ·83 with a median of ·80.

In order to make a partial replication of Kohlberg's factorial investigation a principal components solution was obtained and a varimax rotation performed. The rotated factor matrix is presented in Table 2.

TABLE 2

Rotated Factor Matrix for Nine Situations.

	Factor Loadings	
Situation	I	II
I	·69	·37
II	·75	·14
VII	·85	—·02
III	·63	·45
IV	·52	·39
VIII	·31	·64
V	—·08	·85
VI	·43	·42
IX	·32	·59

The first factor accounted for 43 per cent of the variance and the second for a further 12 per cent. Thomson's (1950) formula for the estimation of the standard error of a factor loading was employed and applied to the second factor in the unrotated matrix. In only three cases, situations III, IV and VI, was the loading on the second factor less than twice as great as the standard error of the loading.

DISCUSSION

The results indicate that both the highest stage of moral judgment used and the proportions in which two or more stages are used vary from situation to situation in the interview. This result was obtained in a group of 12-year-old boys and in a larger sample which included university students. The factor analysis of the scores of the full sample indicated more than one factor operating in responses to this measure of moral judgment. The rotated matrix gives the clearest picture of the operation of these factors. Situations I, II and VII load higher on the first factor than on the second while the reverse is true of situations VIII, IX and V. Situations III, IV and VI load more nearly evenly on both factors.

An understanding of the nature of these two factors demands some attention to the content of these subgroups of situations. Situations I, III and VII all concern two boys, Joe and Alexander, while situations VIII, V and IX all concern adults in more formally defined roles, i.e., a citizen who sights an escaped convict, an army officer who must decide whether or not to send a man on a suicide mission, and an air raid warden who is torn between remaining at his assigned post or going home to his family during an air raid. It can be argued that the two factors discerned deal with what might be termed informal and formal morality and this consideration would lead one to look for a blend of these in the three situations which load more or less evenly on both factors. These situations all involve someone's inevitable death.

In situation III a husband wonders whether to steal a drug for his incurably ill wife, in situation IV a doctor wonders whether he should mercifully despatch the same woman, while in situation VI the officer tries to decide whether he should send a fatally ill soldier or a known troublemaker on the suicide mission. Death, hedged about as it is by rules and sanctions of an extremely formal nature while at the same time involving empathic, personal considerations, is a good example of a matter calculated to involve both of the factors mentioned.

The distinction between what have been termed informal and formal morality is akin to the distinction made by Rest (1970) after an extended logical analysis of the moral stages in terms of two related factors ; the development of role-taking, i.e., the ability to take the perspective of another, and the development of concepts of social structure, rules and roles.

The factor analysis performed in this study is by no means a strict replication of that performed by Kohlberg but it indicates that the assumption that only one factor operates in moral judgment can be questioned.

The variation in stages of moral judgment within a single situation described by Turiel (1969) and between situations, as shown in this study, is precisely the sort of discrepancy which Piaget has termed a horizontal decalage. In the case of such decalages in the attainment of conservation of different sorts of quantity Piaget has shown that the observed order of attainment is paralleled by a logical order. The observed order of preference, comprehension, assimilation, and usage, reported by Rest, Turiel and Kohlberg (1969) in their study of development through the stages is also a logical order similar to that described by Piaget but represents different operations applied to the same set of concepts rather than the same operations successively applied to fresh content.

More refined scoring methods whereby single issues or aspects could be scored for stage would enable one to ascertain the order in which, for example, stage 3 is attained on all the aspects involved in moral judgment. This more detailed analysis and description of development might illuminate the processes of cognitive development in the moral realm.

Turiel (1966) found that upward movement could be stimulated by presenting subjects with arguments one stage above their modal level. The hypothesis that such stimulation would be more effective with more precise matching on single aspects rather than on the basis of modal level seems worthy of investigation. Kohlberg (1970) reports relationships between modal stage of moral judgment and propensity to participate in acts of civil disobedience or to withdraw from a situation in which one is asked to administer electric shocks to another person. Attention to single aspects of moral judgment might increase the predictive power of this measure as well as making clearer the relationship between moral judgment and the sorts of moral choices which have been studied.

The variation indicated by this study is variation between hypothetical situations. A study by Haan (1970), which came to hand when the present study had been completed, showed that only 36 per cent of a sample of university students used the same modal stage of moral judgment in discussing an actual situation of civil disobedience and a selection of hypothetical dilemmas.

It seems then that a description of a subject's development in this area in terms only of his percentage of use of the various stages is too simple. One would need rather to specify the issues involved and record profiles of stage usage on these. The most immediate need is for scoring systems which would make such precision possible and enable further research on specific mechanisms of development in moral judgment and on the relationship of this dimension to moral action.

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RESEARCH ON TEACHER EFFECTS: CRITIQUE OF A TRADITIONAL PARADIGM

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SUMMARY. Process-product studies of the effects of teacher behaviours upon pupil outcomes often employ class mean scores as measures of the outcome variable. Assuming that all the measures used are reliable, a zero correlation between the teacher measure and the pupil outcome implies that the teacher behaviour being studied does not affect pupils in any lawful way. However, such a conclusion may be faulty. This article argues that research on teacher effects should consider pupil variables; teacher behaviours and pupil outcomes may enter into lawful relationships with one another, the nature of the relationship being different for different kinds of pupils. Data from a study of pupils' attitudes to physics are used to support this position.

INTRODUCTION

PROCESS-PRODUCT studies which investigate the effects of teacher behaviour upon pupil learning frequently employ the following paradigm. One or more desired educational objectives, frequently cognitive but sometimes affective, are identified and relevant tests or scales are devised; one or more teacher characteristics thought to be relevant to the desired pupil outcomes are identified, and techniques such as teacher self-rating, independent-observer rating or pupil rating are employed to measure those characteristics. Correlation coefficients between the teacher characteristic measures and the class means of the pupil outcome measures are then calculated and tested for significance. If the correlation is significant, well and good; if not, it may be concluded that the particular teacher characteristic being studied has little effect upon the pupil outcome under investigation.

One serious limitation of such a design is that it fails to take account of the possibility that the same teaching behaviour can influence different pupils in varying, and perhaps even in opposing, ways. By way of illustration, imagine a fictitious experiment in which the process variable was teacher jocularity and the product variable was arithmetic achievement. Assuming that these variables could be measured reliably, a zero correlation between teacher jocularity and class mean arithmetic achievement might imply that the variables were unrelated. However, there is always the possibility of an alternative explanation, namely, that teachers affect different pupils in different ways. Suppose, for example, that humorous teachers elevate the achievement of extraverted pupils, but depress the achievement of introverted pupils and that humourless teachers stimulate introverts and depress extraverts. In this hypothetical example, the presence of interaction effects between teacher behaviour and pupil personality would remain undetected if the pupil personality variable were ignored and class mean achievement scores were employed as the criterion measure.

The purpose of the present paper is to argue that more sophisticated process-product studies which consider pupil personality variables can lead to the discovery of lawful relationships between teacher behaviours and pupil outcomes which would otherwise remain undetected. Selected evidence drawn from a wider study (Gardner, 1972) is used to support this position. The present paper does not claim to be the first to consider pupil variables in process-product research (see, for example, Washburne and Heil, 1960, and St. John, 1971). However, by reporting the contradictory findings obtained when two different modes of analysis were employed, the paper sets out to explicate the issues and argue a case for using more sophisticated research designs.

PROCEDURE

The study from which the present paper is drawn investigated relationships between the attitudes of high school physics students and a number of pupil personality and teacher behaviour variables. The research was conducted in Victoria, Australia; the physics course in this state is based on the American PSSC materials and is taken in the last two years (Grades 11 and 12) of secondary school.

Instruments.

Three instruments were used in the study. The *Physics Attitude Index* (PAI), a 40-item Likert-type scale, was designed to measure four affective outcomes: (1) attitude toward non-authoritarian modes of learning; (2) attitude towards the openness of physics; (3) attitude towards scientists ; and (4) enjoyment of physics. These affective outcomes were derived from an analysis of the writings of developers of the PSSC course. The PAI was constructed in 1967 after undergoing rigorous judging and trial phases, and has been extensively used in other research projects (Mackay, 1970, 1972).

The theoretical framework of the present research may be found in the needs-press model of Murray (1938) and Stern (1970). The model regards human behaviour as an outcome of an interaction between personality variables (' needs ') and environmental influences (' press '). Eight personality variables, taken from Stern's *Activities Index*, were hypothesised to be related to one or more of the attitudes measured by the PAI: *Achievement, Conjunctivity, Deference, Play, Understanding, Order, Nurturance* and *Energy*. An 80-item instrument, the *Personal Preference Index* (PPI) was formed by using items from Stern's original scale.

The third instrument, the *Physics Classroom Index* (PCI), set out to measure the eight teacher press variables corresponding to the eight needs scales in the PPI. The scales are known as *Competitiveness, Organisation, Compliance, Pleasure, Intellectualisation, Compulsiveness, Warmth* and *Stimulation*. The PCI is an 80-item Likert-type scale, to which pupils respond; it underwent an initial judging phase and a preliminary trial (on a sample of newly-matriculated university physics students) before the final form was constructed.

Population.

As the focus of the research was upon pupil personality and teacher behaviour variables, an attempt was made to exert control over a number of extraneous but potentially influential variables such as school facilities and home background. Accordingly, the population for the study was restricted to Grade 11 pupils, taking physics for the first time in 1971, in co-educational high schools situated in regions of above-median socio-economic status in the Melbourne metropolitan area. The schools were all situated in reasonably pleasant suburban areas ; all had qualified physics teachers and moderate class sizes (20-30 pupils).

Testing procedures.

The PAI was administered to students in 38 schools at the beginning of the school year (February) and again at the end of the year (November). The second administration took place prior to any final examinations held within the school. Although the instrument was administered by the class teacher, precautions were taken to ensure the confidentiality of the students' responses. The PPI and PCI were administered in mid-year by a research assistant in the absence of the teacher (but with the teacher's consent). A total of 1,014 students (798 boys, 216 girls) in 58 classes under 40 different teachers in 34 schools provided complete data.

Statistical procedures.

The purpose of the present paper is not to provide a detailed summary of the findings of the project : this is available elsewhere (Gardner, 1974). The focus here is upon the failure of the commonly used process-product paradigm to uncover subtle relationships which may exist between teacher and pupil variables. The statistical procedures which are pertinent to such a discussion are : (1) the calculation of the reliabilities of the teacher behaviour scales used in the research (since failure to uncover a significant relationship could be due to unreliable scales) ; (2) the calculation of the correlations between class mean PAI and PCI scores (i.e., the common process-product paradigm) ; and (3) a two-way analysis of covariance design (with unweighted-means adjustment for unequal cell frequencies) which allowed pupil personality effects and pupil/teacher interaction effects to be studied.

For each needs-press pair, the needs variable served as one ' treatment ' variable, the press variable as the other. Each treatment variable was studied at four levels : PCI class means were used to allocate each class to one of four levels on the press variable, and individual PPI scores were used to allocate individual students to one of four levels on the needs variable. Final (November) attitude was the criterion, initial (February) attitude the covariate. As in the correlational analysis, the class mean PCI score provides measures on the teacher behaviour variable. However, for the pupil outcome, the statistical unit in the covariance analysis is now the individual student and not the class.

RESULTS

Enjoyment of physics. The discussion which follows is limited to the findings involving the *Enjoyment of physics* scale. It was this scale that entered into the largest number of relationships with the predictor variables ; it was also on this scale that students displayed the largest change during the Grade 11 year. The 10-item scale has a potential range of scores from –20 (extremely unfavourable attitude) to +20 (extremely favourable attitude) ; the actual range of scores covered the entire potential range, indicating the sensitivity of the scale. The mean score of the sample declined from +8·36 in February to +5·70 in November ; a t-test for correlated samples indicates that this decline is significant beyond the ·0001 level.

Reliabilities. The corrected split-half reliability coefficient of the *Enjoyment of physics* scale (based on the pooled data of the 1,014 students who provided complete data in the study) was ·89, a value consistent with that obtained in earlier research.

Corrected split-half reliabilities of the eight PCI scales (again, based on N=1,014) were ·67, ·91, ·72, ·78, ·86, ·76, ·89 and ·89. Data from an independent sample (the university students in the trial sample) are in substantial agreement. The scales appear to possess adequately high internal consistency.

The scales also appear to display adequate stability across classes. In 18 of the 34 schools in the sample, one physics teacher taught two parallel classes. Correlations of one set of 18 class mean PCI scores with the other set of class means provide a rough index of the stabilities of the teacher behaviour across classes. The correlations for the eight scales were ·81, ·87, ·84, ·81, ·78, ·96, ·83 and ·78. In other words, two classes with the same teacher agree fairly well with one another about the behaviour of their teacher on the various scales.

Correlations between PAI and PCI class means. If one follows the common process-product paradigm, the appropriate statistics to calculate are the correlations between the class mean product scores (in this case, November *Enjoyment of physics*) and the teacher behaviour measures (in this case, the eight PCI class mean scores). The statistical units for this calculation are the 58 classes which provided complete data. The findings are presented in Table 1.

TABLE 1

CORRELATIONS BETWEEN ENJOYMENT OF PHYSICS AND PCI CLASS MEANS.

PCI Scale	Correlation with *Enjoyment*	P <
1. Competitiveness	·25	·05
2. Organisation	·41	·001
3. Compliance	·04	NS
4. Pleasure	—·07	NS
5. Intellectualisation	·34	·01
6. Compulsiveness	·29	·05
7. Warmth	·16	NS
8. Stimulation	·35	·01

The data would appear to lead to the following conclusions :

(*a*) (Scales 2, 5, 6 and 8). Teachers who are well-organised in their presentation of lessons, who support and themselves display interest in intellectual endeavour, who organise their physical environment fairly carefully, and who are enthusiastic and energetic, are associated with higher class mean enjoyment of physics.

(*b*) (Scales 3 and 7). The extent to which teachers demand compliance, and the extent to which they are warm and friendly, do not appear to be significantly related to enjoyment. (In passing, it should be noted that most teachers scored fairly low on the *Compliance* scale and moderately high on the *Warmth* scale.)

(*c*) (Scale 4). The extent to which teachers display playful, pleasure-oriented behaviour as against serious, work-oriented behaviour, is unrelated to enjoyment of physics.

(*d*) (Scale 1). Teachers who stress achievement are associated with higher enjoyment of physics.

As will be seen from the discussion which follows, conclusions (*c*) and (*d*) cannot be sustained.

Analysis of covariance. The analysis of covariance findings are summarised in Table 2.

TABLE 2

ENJOYMENT OF PHYSICS : SUMMARY OF ANALYSIS OF COVARIANCE FINDINGS.

PPI Scale	P<	PCI Scale	P<	Interaction effect	P<
1. Achievement	·001	Competitiveness ..	·01	yes	·05
2. Conjunctivity	·01	Organisation	·001	no	
3. Deference	·05	Compliance........	NS	no	
4. Play	·001	Pleasure	NS	yes	·05
5. Understanding	·001	Intellectualisation	·001	no	
6. Order	NS	Compulsiveness	·001	no	
7. Nurturance	·01	Warmth	NS	no	
8. Energy	·05	Stimulation	·001	no	

In six cases (involving PCI scales 2, 3, 5, 6, 7 and 8) the conclusions reached concerning the influence of the teacher behaviour are identical to those reached using correlations between class mean scores. (The higher levels of significance arise because of the much larger number of degrees of freedom obtained when individuals and not classes are the statistical units.) Thus, conclusions (*a*) and (*b*) still stand as a result of the covariance analysis.

Conclusion (*c*), however, does not. It will be recalled that the correlation between the teacher *Pleasure* and the pupil *Enjoyment* class means was a non-significant $-\cdot07$. The analysis of covariance shows that pupil *Play* (PPI Scale 4) exerts a significant main effect ($F_{(3,997)} = 8\cdot4$, $P < \cdot001$) ; teacher *Pleasure* as a main effect is not significant ($F_{(3,997)} = 1\cdot2$), but there is a significant interaction effect ($F_{(9,997)} = 2\cdot1$, $P < \cdot05$). Table 3 displays the cell means.

TABLE 3

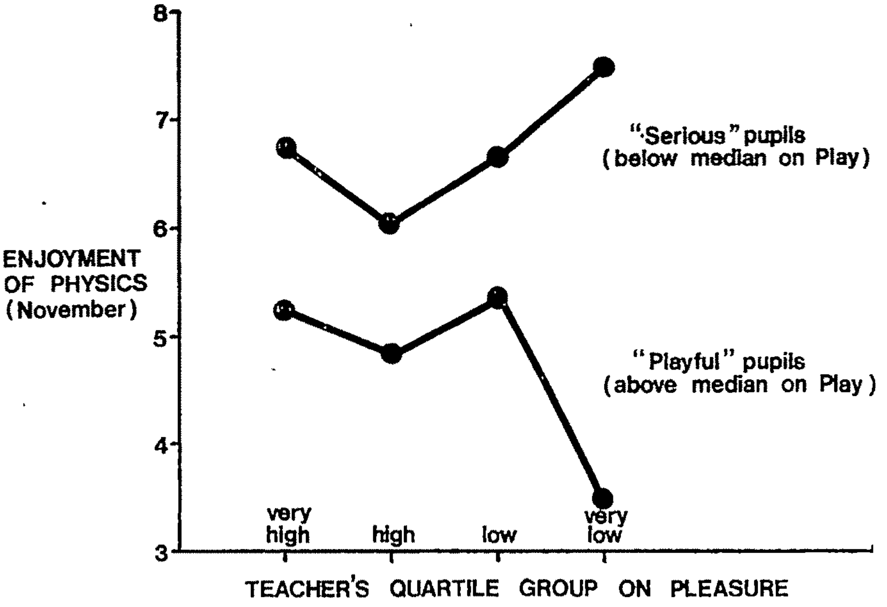
FEBRUARY AND NOVEMBER CELL MEANS ON ENJOYMENT OF PHYSICS SCALE.

	Quartile Groups on Pleasure											
	Very high			High			Low			Very low		
	N	Feb.	Nov.	N	Feb.	Nov.	N	Feb.	Nov.	N	Feb.	Nov.
Quartile Groups on Play :												
Very high	67	7·48	4·00	64	6·33	4·53	66	7·64	4·53	49	8·14	3·55
High	75	8·36	6·43	71	8·69	5·15	93	7·80	5·92	65	8·34	3·38
Low	45	8·16	5·60	63	7·27	4·41	67	8·54	6·42	62	9·24	6·77
Very low	45	9·47	7·96	55	9·42	7·67	59	9·68	6·88	68	9·87	8·18

Some visual assistance in comprehending the data in this table can be provided by a graphical presentation in which the November data from students in the upper two quartiles on PPI 4 are combined; data from students in the lower two quartiles are similarly combined. The attitudes of these two groups of students—the 'serious' and the 'playful'—under four levels of teacher behaviour on the corresponding press scale may then be compared. The data are presented in Figure 1; each plotted point is the mean of two cell means.

FIGURE 1

Enjoyment of Physics at end of year by Serious and Playful Pupils under Four Levels of Teacher Behaviour on PCI 4.



This graph clearly demonstrates the lack of an overall teacher effect; the mean of the four points on the left (teachers relatively high on *Pleasure*) is not significantly different from the mean of the four points on the right. However, there is a very pronounced difference between the serious and the playful pupils with teachers very low on *Pleasure*, and this accounts for the significant interaction term.

To sum up, the very serious pupil will tend to maintain a more favourable attitude to physics than the less serious pupil; placed in the classroom of a very serious teacher, he will fare even better. On the other hand, the less serious pupil, already more likely to decline in attitude, will decline even more if placed with a very serious teacher.

The same teaching behaviour can, therefore, have markedly different effects depending on the personality of the pupil. In the correlational analysis of class means, the interaction effect was entirely obscured, and this led to a faulty conclusion.

Conclusion (*d*), although not overturned by the covariance analysis, is in need of modification. The correlation analysis implied a simple main effect of teacher *Competitiveness* upon pupil *Enjoyment*. The analysis of covariance provides partial support for this—for most pupils, teachers who are high on *Competitiveness* tend to be associated with higher enjoyment—but again there is a significant interaction term ($F_{(9,997)} = 1\cdot 9$, $P < \cdot 05$).

TABLE 4

February and November Cell Means on Enjoyment of Physics Scale.

	Quartile Groups on Competitiveness											
	Very high			High			Low			Very low		
	N	Feb.	Nov.	N	Feb.	Nov.	N	Feb.	Nov.	N	Feb.	Nov.
Quartile Groups on Achievement :												
Very high	62	9·73	9·42	60	10·43	8·13	61	9·98	7·05	63	10·11	8·10
High	36	9·36	8·36	53	8·96	7·38	36	10·03	5·42	19	8·95	4·37
Low	111	7·93	5·86	96	7·82	5·34	109	7·39	5·21	81	7·89	4·37
Very low	63	7·43	3·56	54	7·04	2·72	45	6·13	1·76	65	7·05	4·11

Inspection of the November *Enjoyment of physics* cell means in Table 4 quickly permits one to locate the source of the interaction effect. The value in the lower right-hand corner is much higher than one would expect on the basis of the trends in the fourth row or the fourth column. Extrapolating the values 3·56, 2·72, 1·76 . . . and 8·10, 4·37, 4·37, . . . would lead one to expect a value somewhat less than 1. Instead, we have a value of 4·11, much higher than would be expected on the basis of the row and column trends and higher in fact than any other November value in the fourth row. The typical very low achievement-oriented student, therefore, starts the year with a fairly positive attitude to physics, but this declines markedly during the year. However, those students who are placed in a class with a teacher described as very low on *Competitiveness* display a much smaller decline and a more favourable final attitude than students under teachers in the other three quartile groups.

In short, very high achievement-oriented students best maintain their positive attitudes with teachers in the highest quartile on *Competitiveness* ; very low achievement-oriented students fare best in an environment which is very low on *Competitiveness*. In simple language, the high achiever likes to be prodded, whereas the low achiever enjoys the subject more if he is not.

DISCUSSION

The findings indicate that it is possible for the same teaching behaviour to have markedly different effects, depending on the personality of the pupil. Achievement-pressing teachers tend to have a beneficial effect upon the enjoyment of physics of highly achievement-motivated pupils, but a relatively deleterious effect upon pupils with very low achievement motivation. Very serious teachers tend to have a beneficial effect upon the already more favourable attitudes of serious pupils, but a deleterious effect upon the attitudes of playful pupils. These relationships were not uncovered by the commonly used paradigm which employs class means as measures of pupil outcomes. The implications for researchers seeking to discover lawful relationships between teacher behaviours and pupil outcomes would seem to be that (1) pupil personality variables ought to be considered in this type of research; (2) class means on outcome variables may not always be appropriate measures to use in research on teacher effects; and (3) statistical designs more sophisticated than simple correlation coefficients ought to be employed.

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LECTURERS' PERCEPTIONS OF THE INFLUENCE OF IDEAS ON THE CURRICULUM OF COLLEGES OF EDUCATION*

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SUMMARY. Using data arising from ratings by lecturers in seven colleges of education for ' actual,' ' ideal ' and ' change in ' influence, this article explores the degree of influence which 20 relevant ideas are considered to have on the operational curriculum of the college; on what in fact, students are taught. It also attempts tentatively an analysis of the structure of the influences and a description of the media which each sub-system of influences employs. Results suggest that progressive, child-centred ideas are most influential both actually and ideally, and are likely to remain so, and that the ideas fall into discernible groupings each of which may play some part in influencing courses of study in colleges.

INTRODUCTION

THE study reported here is one of a number into the forces which shape the curriculum of educational institutions. So far the studies, using the term ' curricular influence system ' to designate their scope, have concentrated on institutional influences ; on the influence of individuals and groups with particular roles to play in organisational settings (Taylor and Reid, 1971 ; Taylor *et al.*, and Taylor and Adams, both in press). This study focuses on the influence of ' forms of thought ' or ideas on the curriculum of colleges of education. In so doing it assumes, not unreasonably, that ideas influence social behaviour, serving to persuade people to adopt particular values and practices. It also assumes that the curriculum is considered to be a formal means for the exercise of influence on the minds and behaviour of students, disposing them to ways of thinking and acting considered appropriate to intending members of the teaching profession.

In the studies noted above the main focus of interest has been on the *de facto* or operational curriculum, on what, in fact, is taught rather than on what should be taught, and this focus has been retained in the present study. Staffs of colleges were asked to rate ideas for their influence on ' what the students at your college are taught.'

The ideas whose influence was studied were derived in relation to four broad categories :

(1) *Ideas arising from concepts of education*, e.g., education as an initiation into a system of moral values, education as the transmission of culture.

(2) *Ideas arising from the study of education*, e.g., the ideas of educational psychologists, sociologists and philosophers, together with ideas arising from both academic disciplines and from the beliefs of practitioners about effective teaching.

(3) *Ideas arising from the expectations of others*, e.g., the expectations that education would promote the interest of society, those of the teaching profession, that college education would equip students with a range of practical skills.

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(4) *Ideas arising from current trends in education*, e.g., from prevailing modes of thought such as curriculum integration, team teaching and from such national reports as Crowther, Newsom and Plowden.

In selecting ideas for inclusion, especially in relation to the first category, the relevant literature, including a wide range of national reports, was reviewed and commonly occurring phrases and terms employed in the construction of the final items. It was assumed that by building items in this way each would signal a larger meaning than the few lines available to it in the questionnaire. Furthermore, the inclusion of terms or phrases in an item should not be taken to indicate approval of them any more than should the rating of the items be taken to indicate either an appreciation by the lecturers of the full meaning to which they relate or ignorance of it. The encapsulation of complex philosophic positions in catch phrases and slogans is a common phenomenon in educational writings, and it seemed reasonable to accept the economy which this fact offered in the construction of the ideas to be rated.

The ideas were set out in expanded form so that the risk of misunderstanding and ambiguity would be minimised. For example, (14) *The ideas of educational psychologists*, e.g., Piaget, Bowlby, Burt, Peel, etc., on how children think and develop, and (5) *Education as the means of developing the child's full potential*, e.g., to achieve self-realisation for the child, the interests of the child as the criteria. In this way ideas for each of the four categories were constructed.

In all 20 ' ideas ' were developed (see Appendix for details) and set down in random order for rating by college lecturers on three counts : the *power each possesses to influence* what students are taught, i.e., actual influence ; the *power each ideally ought to possess* to influence, i.e., ideal influence ; and the *likely increase or decrease in power* to influence in the future, i.e., change in influence. The ratings all called for the use of a five-point Likert-type scale.

THE SAMPLE

Seven colleges selected to represent the different sizes and biases to be found within a large ATO agreed to co-operate, and a stratified, random sample of 200 lecturers was chosen. Stratification was by both status and area of teaching. The questionnaire containing the schedule of ideas to be rated was returned by 136 members of staff who were roughly representative of the areas of teaching to be found in colleges generally—i.e., 41 education, 30 sciences including mathematics, 35 arts and 29 expressive subjects, i.e., art, music, etc. About a quarter were women (23·7 per cent) and just less than one-third held posts of responsibility. (One person, a tutor-librarian, was not classifiable by subject area.)

METHODOLOGY AND RESULTS

For each of the 20 ideas and for ratings for ' actual,' ' ideal ' and ' change in ' influence, means and standard deviations were obtained. In addition, factor analyses were carried out on the ' actual ' and ' ideal ' ratings and their varimax solutions are presented. The results are given below in two sections.

(1) *Strength of Influence.*

Table 1 gives the mean ratings and the standard deviations for both the actual ' and ' ideal ' influence of the 20 ideas and shows how far one idea, stands out clearly from the rest in strength of influence. For both 'actual' and 'ideal' ratings, item 5, *Education as the means of developing the child's full potential*, is rated the highest. This salient idea stands together in actual influence with three others as 'strong' influences on the curriculum of colleges. Between them and with the addition of item 20, *The ideas about effective teaching which have arisen from the insights of practising teachers*, which is rated only a little lower, they represent some of the sometimes contradictory notions of child-centredness, of theories of learning and motivation, of fashion in educational theory and practice and of competence in the classroom based on pragmatically developed theories of teaching for which the curriculum of colleges must attempt to find a place, though not to the exclusion of any other ideas, for none was rated as having 'very little' or 'no' influence.

Least actual influence was accorded to item 13, *Education as an agent of society*. This is not surprising in the light of the strength of the child-centred idea of education and the low rating of the transmission of culture conception of education (item 17). These ratings seem reliably to reflect the prevailing educational preoccupations of colleges, just as they reflect the relatively light influence of curriculum innovation and development and the ideas developed in reports of the Central Advisory Council (items 7 and 16) on the curriculum of colleges.

TABLE I

IDEAS: ACTUAL AND IDEAL · MEANS AND STANDARD DEVIATIONS OF RATINGS FOR INFLUENCE.

Item No.	Description	Means		SDs Actual	Ideal	Degree of Influence
		Actual	Ideal			
5	Education as the means of developing—full potential.	3·9	4·2	0·9	0·8	Strong
14	Ideas of educational psychologists	3·6	3·7	0·8	0·8	
4	Prevailing modes of thought in education	3·6	3·5	0·8	0·8	
3	Expectations of the teaching profession	3·5	3·6	0·8	0·8	
				3·5		
20	Ideas about effective teaching....	3·4	3·8	0·9	0·8	Some
15	Changes in teaching methods	3·3	3·5	0·8	0·8	
1	Ideas of educational philosophers	3·3	3·5	0·8	0·8	
12	Academic disciplines............	3·3	3·4	0·8	0·8	
9	Traditions of the college	3·2	2·6	1·0	1·0	
16	Reports of Central Advisory Council	3·2	3·5	1·0	0·8	
19	Expectations of society	3·2	3·6	0·8	0·9	
7	Curriculum innovation and development	3·2	3·5	0·8	0·7	
6	Expectations of the students.. ..	3·2	3·3	0·8	0·9	
11	Changes in society	3·1	3·1	0·9	0·8	
8	Ideas of educational sociologists..	3·0	3·3	0·9	0·9	
2	Education as initiation into—moral values	3·0	3·4	0·9	0·9	
10	External examination	3·0	2·1	0·8	0·8	
18	Developments in knowledge and theory	2·9	3·2	0·8	0·8	
17	Education as transmission of culture	2·9	3·4	0·9	0·8	
13	Education as an agent of society..	2·8	3·1	0·9	0·9	
				2·5		

If these represent the actual influences on the curriculum of colleges, at least as seen by those who work in them, what would the ideal be like and is the future likely to move toward or away from it?

What weight the ideas ought to have in influencing the curriculum of the college may be seen from the ideal ratings in Table 1. Sixteen of the ideas increase their influence, three decline and one remains the same. In four cases—item 17, *Education as the transmission of culture*, item 2, *Education as an initiation into a system of moral values*, item 19, *Expectations of society*, and item 20, *Ideas about effective teaching which have arisen from the insights of practising teachers*—the increase is almost half a rating interval or more. Such ratings lead to the displacement of educational psychology (item 14) as second in importance to the child-centred idea of education (item 5) by item 20, *Ideas about effective teaching which have arisen from the insights of practising teachers*, and bring the traditional ideas about education into the middle ground and give greater prominence to social expectations. In the context of these shifts towards what ought to be the case, the external examination ceases to be of ' some importance ' as an influence and becomes of only ' little importance,' as does item 9, *Traditions of the college.*

These shifts in rating seem to suggest a move toward practicalities which, though they do not lose sight of the belief in child-centred education, reassert in some small measure the more traditional notions of education and the social responsibilities of colleges. They also suggest a concern of the colleges for greater independence from external controls and a release from customary attitudes.

TABLE 2

IDEAS : CHANGES IN INFLUENCE : MEANS AND STANDARD DEVIATIONS.

Item No.	Influence	Mean	SD	Change
6	Expectations of students	3·7	0·8	Increase
11	Changes in society	3·7	0·6	
7	Curriculum innovation and development	3·6	0·7	
4	Prevailing modes of thought in education	3·6	0·7	
15	Changes in teaching methods	3·6	0·7	
8	Ideas of educational sociologists	3·5	0·7	
5	Education—developing child's full potential	3·5	0·9	
		3·5		
19	Expectations of society	3·3	0·9	No change
3	Expectations of the teaching profession	3·3	0·7	
18	Developments in knowledge and theory	3·3	0·6	
13	Education as an agent of society	3·3	0·7	
20	Ideas about effective teaching	3·3	0·7	
14	Ideas of educational psychologists	3·2	0·6	
16	Ideas developed in national reports	3·2	0·6	
12	Academic disciplines	3·0	0·7	
1	Ideas of educational philosophers	3·0	0·7	
10	External examination	2·9	1·0	
17	Education as the transmission of culture	2·8	0·7	
2	Education—initiation into systems of moral values	2·7	0·7	
		2·5		
9	Traditions of the college	2·4	0·8	Decrease

The likelihood of the ideal state of affairs being achieved may be estimated from the ratings for increase or decrease in influence given in Table 2. Seven ideas are seen as likely to increase their influence and one to decrease. For the remainder no change is considered likely. Of the increases in influence most sought after as ' ideal,' none is thought likely to increase in influence, though one of those whose influence under ' ideal' rating was to decline, item 9, *Traditions of the college*, is expected to cease to have any influence at all. The same is not true for external examinations. Their influence is expected to remain unchanged.

The expected increases in influence mostly concern practical developments already taking place in the educational system under the press of social changes, developments which aim to give rise to greater pupil and student involvement in learning and to developments in school curricula and to improved teaching methods. Child-centred notions are part of this pattern as are the ideas of educational sociologists. But there is no evidence of a shift towards a modest reinstatement of traditional views of education nor of the emergence of the influence of ideas based on codified practices, i.e., pedagogics.

(2) *The Structure of Influences.*

Parsons (1963 and 1971) suggests that influences work through different media—some through the medium of values and beliefs, others through norms and expectations, and others through allocation of resources. All influences, he suggests, no matter what form they take, are a generalised symbolic medium of social interchange. It is in order to explore the generalised form which the influence of ideas on the curriculum of colleges may take that factor analysis has been employed. It has been employed heuristically (Tukey, 1969) to afford a tentative description of the form of influence which groups of ideas acting as sub-systems of influence may exert on the curriculum of colleges.

The factor analysis of ratings for the ' actual ' influence of ideas resulted in four factors with eigen values greater than unity and accounting for 50·8 per cent of the total variance. The first factor with 20·9 per cent variance and high loadings (i.e., over 0·7) on items 14, 15, 16 and 5, i.e., the ideas of educational psychologists, changes in teaching methods taking place in schools, views put forward in national reports and the concept of education as developing the child's full potential, together with strong supporting loadings (over 0·5) on items 4, 7 and 8 concerned respectively with the prevailing modes of thought in education, curriculum innovation and the ideas of educational sociologists, suggests a grouping of innovative, progressive ideas and seems best described as the generalised influence of the progressive, child-centred, innovative idea. The medium of influence for this sub-system might well be the appeal to change in the progressive mode.

The second factor (10·3 per cent variance), with high loadings on items 20, 6, 3 and 19, bears on the practicalities of teaching and is described as the influence of expectations for the useful and practical in teaching. Here the medium of influence would appear to be that of pragmatism.

Factor three with 9·6 per cent of the variance is defined by three loadings over 0·5 : on items 9, 12 and 10, and two with loadings over 0·4, items 2 and 3. Traditions of the college, academic disciplines, and examinations, together with education as initiation into a moral order and expectations of teachers, usually rated as conservative, suggest the influence of the formal and traditional. Here the appeal of ideas is to that of customary and conventional knowledge and practices.

The influence of the idea of education for society describes the final factor accounting for 10 per cent of the variance. Its highest loadings are on items 13, 17 and 11 with supporting loading on item 19, *Expectations of society*, and its appeal is to the social function of education.

These four factors represent the sub-systems of influence on the *de facto* curriculum of colleges of education as these influences are perceived by college staffs. The influence of each of the 20 ideas may be thought to carry the ' valency ' or appeal of the sub-system to which it belongs though some carry more than a single appeal depending on the context in which they appear, and in this respect some ideas turn out to play unexpected roles. The ideas of educational philosophers, for example, is one such influence. With by far its largest loading (0·59) on the first factor, the ideas of educational philosophers would seem to make their contribution by amplifying and extending the metaphors through which meaning is given to the child-centred, progressive mode in education (Cheverst, 1972) rather than by the formal analysis of educational issues which is the role in which the philosophy of education is currently cast (Hirst, 1966).

The factor analysis of ' ideal ' influences accounting for 63·7 per cent variance replicated almost exactly the four factors for the ' actual ' influence of ideas but added two further factors with eigen values above unity. These are described as the influence of conceptualisations of ' education ' and the influence of changes in knowledge.

The first of these additional factors with 9 per cent of the variance collects together ideas which propose differing views of the child, of teaching and learning (items 2, 1, 5 and 14), and its appeal may well be to rationality, i.e., to an awareness of the differing concepts of education and their logical structure. If this interpretation is right, then it seems that in an ideal world staffs of colleges might be more concerned than may be the case at present with teaching conceptual clarity in the handling of issues in teaching.

The other additional factor with 8·6 per cent variance, described as the influence of changes in knowledge especially of the academic disciplines (item 12), though to a lesser extent also with changes in the deployment of knowledge in school subjects through curriculum innovations and development (item 7), holds its appeal through the role of knowledge in the education of teachers as well as in education generally. It probably arises as a distinct factor because under an ideal dispensation main or principal subject lecturers see knowledge of the disciplines as an independent territory making its own contribution to change, and is in no way associated with the appeal to change made by advocates of ' progressive ' education. To some extent this factor appears as one strongly perceived by staff but not by students in a study of the goal structure of a college of education by Kitchen (1972). The one most strongly perceived by students was what Kitchen termed ' Teaching skills,' not unrelated to the factor described above as ' Influence of expectations of the useful and practical.'

A rough estimate may be made of the relative weight which each sub-system of influence might play in the total of influences by taking the weighted mean for the high loadings on each factor, i.e., for loadings over 0·5. The results are given in Table 3 and indicate that, in terms of actual influence, relatively greater influence is brought to bear through appeal to the progressive innovative mode and least by concern for social needs to which teacher education may be expected to respond. Under ideal influences slightly greater weight of influence is accorded to awareness and rationality in dealing with differing conceptions of education than to the progressive, innovative mode. Additionally, the appeal to tradition falls relative to that of social need which rises. The appeal to the practical retains its relative position. Some of these shifts in emphasis in influence on what colleges teach from actual to ideal might well come about in the near future if the ratings for changes in influence have any validity, especially the relatively stronger concern with the expectations of society. Other portended changes—greater rationality in dealing with conceptions of education—do not seem likely to rise in influence in the immediate future which may be preoccupied by the expected rise in the influence of students and the unknown but potentially powerful influence of changes in society.

TABLE 3

ESTIMATES OF THE RELATIVE WEIGHT OF 'ACTUAL' AND 'IDEAL' INFLUENCES: MEANS.

Influence sub-system	Actual	Ideal	Form of Influence
Progressive: Innovative	3·5	3·5	Change in a progressive mode
Expectations for the Useful ...	3·3	3·5	Pragmatic of teaching
Traditional Ideas	3·2	2·4	Tradition
Education for Society	2·9	3·2	Social need
Conceptions of Education	—	3·6	Awareness and rationality
Changes in Knowledge	—	3·3	Role of knowledge

Just how much the expected increase in influence of educational sociologists, especially in the field of the sociology of knowledge, will alter the shape and mode of the sub-systems of influence is difficult to say. What can be said is that the currently strong influence of the progressive innovative mode is likely to continue. It serves among other things to provide the medium of doctrinal conversion so commonly to be found in training institutions (Davis, 1958) and with the lack of deference to tradition there is nothing to replace it.

DISCUSSION

Ideas help shape what we do and how we do it. They also shape the decisions which are made about what to teach and how to teach it. This article has explored how lecturers rate a set of ideas for the influence which they believe them to have on the curriculum of colleges of education, and has suggested how, within the set of ideas, there may be particular groupings of ideas each with its own form of appeal and influence. It has also shown that a shift toward the ideal might bring into prominence as curricular influences the pragmatics of teaching, i.e., pedagogics, and society's claims on the colleges for teachers with practical capabilities. Data on likely changes in influence suggest that such a shift in influence is only partly expected.

Ratings of the strength of influence suggest that the progressive mode is perceived as strongest under both actual and ideal conditions and the rating for change suggests that it is likely to remain so.

Whether or not such ratings have an operational validity, and whether or not, and in what ways, ideas influence the curriculum both as it is transacted and as it ideally might be, through different media, remains to be verified by studying in detail the role of ideas as they influence what is taught in colleges through discourse, in teaching, in assessing and in the implicit as well as the explicit learning demands made of students. Such study would be essentially that of the transaction of ideologies, their media and potencies in the education of prospective teachers. As Messick (1971) says: "Given the central role of ideology in determining aims and action in education, it would seem imperative that we undertake systematic analyses of how ideological dispositions affect action through the medium of judgment and decision making," quoting Dewey (1964) and Stake (1970). Not least are such analyses needed in the field of teacher education.

This study has been based on the perception of lecturers in colleges and represents one tentative approach to research into the influence of ideas in the education of teachers. What it may serve to have done is to provide a beginning framework for further research.

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APPENDIX

Ideas.

1. *The ideas of educational philosophers*, e.g., Plato, Rousseau, Dewey, R. S. Peters, etc., about what education is and what purpose it should serve.
2. *Education as an initiation into a system of moral values*, e.g., obedience to rules of good conduct, concern for others, religious beliefs.
3. *The expectations of the teaching profession*, e.g., that colleges will equip students with a certain range of practical school and classroom capabilities.
4. *The prevailing modes of thought in education*, e.g., integrated studies, team teaching, group work, etc.
5. *Education as the means of developing the child's full potential*, e.g., to achieve self-realisation for the child, the interests of the child as the criteria.

6. *The expectations of the students of what a college education should offer them,* e.g., to show them how to teach, to understand one or more fields of study and launch them on a career.
7 *Curriculum innovation and development,* e.g., the work of the Schools Council and Nuffield Foundation in curriculum innovation and change.
8. *The ideas of educational sociologists,* e.g., work on social class and education, on home-school relationships, on schools as institutions, etc.
9. *The traditions of the college,* e g., what the college has always stood for in teaching and academic work.
10. *The external examination,* e.g., the content and style of questions and standard of marking employed.
11. *Changes in society,* e.g., the stress on technology, the emergence of a more permissive less authoritarian system of values, etc.
12. *Academic disciplines,* e.g., the nature of science, language, mathematics, history, etc.
13. *Education as an agent of society,* e.g., that the purpose of education is to promote the interests of society.
14. *The ideas of educational psychologists,* e.g., Piaget, Bowlby, Burt, Peel, etc., on how children think and develop.
15. *Changes in teaching methods, organisation, etc., taking place in schools,* e.g, unstreaming, block timetabling, etc.
16. *The ideas developed in reports of educational commissions,* e.g., Plowden, Newsom and Crowther Reports.
17. *Education as the transmission of culture,* e.g., education as the passing on of knowledge from generation to generation.
18. *Developments in knowledge and theory produced by university scholars,* e.g., discoveries in science, new methods in geography, new theories of the curriculum, new interpretations of literature, etc.
19. *Expectations of society,* e.g., that college education should fit students to become efficient teachers aware of social needs.
20. *The ideas about effective teaching which have arisen from the insights of practising teachers,* e.g., the practical know-how which arises from experience in school.

THE CHECKING OF PRIMARY ABILITY STRUCTURE ON A BROADER BASIS OF PERFORMANCES

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SUMMARY. A battery of 57 ability tests, spanning the full range of the ability domain, was administered to 343 young adults. The aims were to confirm the differentiability of the better-known primary mental abilities and to assess the differentiability of the more recently hypothesised abilities, along with their relationships with the better-established constructs. A common-factor analysis of the 57 variables revealed 19 correlated primary abilities, ranging from such established factors as Verbal and Numerical ability to less well-understood primaries in the memory and fluency-originality areas. The conceptual nature of the factors and their interrelationships are discussed, and the results are placed in the context of earlier research on abilities.

THEORETICAL SETTING

PSYCHOLOGISTS today are presented with two different systems for understanding the structure of primary abilities: that of Thurstone, beginning with his demonstration (1938) of some seven or eight primary ability factors, and that of Guilford (1967), presenting a rather more numerous list of unitary ability factors but rotated arbitrarily to orthogonal positions.

If factors are to be considered organic influences or determiners, rather than mathematical abstractions, suitable only for classificatory schemes, then it is necessary that rotation be to unique simple structure. On the argument that simple structure commonly requires freedom for influences to be oblique (correlated), the present investigators are building upon Thurstone's rather than Guilford's position, and the present research has its meaning in that setting. Incidentally, an immediate and important consequence of oblique primaries is the possibility of second and higher-order ability factors. Thurstone, as is well known, reconciled his position with Spearman's by locating the latter's general ability factor at the second order—and with a positiveness of rotation impossible by Spearman's approach. More recently, Cattell (1963, 1971) has marshalled evidence for several second-order factors, two of which are general intelligences, fluid and crystallised.

Although the present paper deals with the first-order factoring only, later articles (Hakstian and Cattell, 1974a, 1974b) explore the second and third strata. These papers attempt to clarify this structure in terms of Cattell's (1971) *Triadic Theory* of ability development. The higher-order issues are mentioned here only to bring out some of the reasons for choice of performances at this primary stage, and to make clear that we consider the understanding of primaries and secondaries to be illuminated by their mutual relations.

The purpose of the research from which the present paper springs is both theoretical and practical. Though considerable progress has been made (in the Thurstone framework) by the researches on primaries first summarised by French (1951), more recently expanded by Horn (1968) and Horn and Cattell 1966), and placed in the theoretical framework of the *ability dimension analysis chart* by Cattell (1971, p. 67), the exploration of the domain is still far from complete. And apart from sheer need to explore, by systematic extension into new areas (a task, incidentally, brilliantly and indefatigably carried out by Guilford and his associates in the purely orthogonal framework), there is a need here also to clarify the strata relations among factors of different order. For, if Cattell's (1971) Triadic Theory is correct, there lies between the stratum of the broad *capacities* such as fluid intelligence, crystallised intelligence, intellectual speed, etc., and the primary stratum of what may psychologically be called *agencies* a third, intermediate stratum of ' provincial ' *powers*, such as visual and auditory organising powers. Thus, a careful check on factor order relations has a bearing on the psychological interpretations in the Triadic Theory of agencies (*a*'s), powers (*p*'s) and capacities (*c*'s) as resting on diverse origins in neural anatomy and cultural learning. Our practical aim in the overall research has been to improve the definition and extend the list of the primary abilities, in the interests of constructing a new battery of shorter but factorially pure and more construct valid tests of (*a*) the better established and (*b*) hitherto unknown or poorly understood primary mental abilities. It is envisioned that such a battery will have many uses ranging from providing theoretically useful constructs for research purposes to providing data of value for practical criterion-prediction purposes in counselling, etc.

The immediate purposes of the present paper are to (*a*) confirm the differentiability and interrelationships of the better-known primary factors, (*b*) assess the differentiability of the more recently hypothesised primaries, and (*c*) examine the relationships between the older and newer primaries. Thus, although some examination is reported in the present paper of the interrelationships among the primary factors found, such an investigation—using higher-order factor analytic methods—constitutes the substance of later papers (Hakstian and Cattell, 1974a, 1974b).

THE NATURE OF THE TESTS

Such sources as French (1951) and Guilford and Hoepfner (1971) offer suggestive evidence on hypothetical primaries beyond those of Thurstone and Thurstone (1941). But probably the most positive extension of the domain in recent years has arisen from the work by Horn (see Horn, 1968; Horn and Cattell, 1966), who presented evidence for at least 18 primaries. For the purpose of the present study, the best single source of test item types was French, Ekstrom, and Price's (1963) *Kit of Reference Tests for Cognitive Factors*. For some of the more recently discovered primaries, Guilford and Hoepfner's (1971, Appendix B) list of sample items was useful. From these various sources and the accumulated literature on abilities, the authors isolated relevant item types from which to construct the tests. All tests and items used were, however, new, and each was thus constructed to mark either a better-established or newer and less well-understood primary factor.

The tests developed for the study are listed in Table 1. Some explanation of the material in Table 1 may be in order at this point.

TABLE 1

SUMMARY OF VARIABLES INCLUDED IN THE STUDY
(Abbreviations given for hypothesised factors are used in the sequel.)

Test No.	Test Content	Work Time (Seconds)	No. of Items	Mean	SD	Hypothesised Primary Factor
1	Vocabulary	240	18	6·30	4·28	Verbal (V)
2	Proverbs	180	9	5·71	2·20	
3	Verbal Analogies	180	9	2·16	1·55	
4	Arithmetic Calculation	210	12	5·13	2·43	Numerical (N)
5	Arithmetic Calculation	210	12	5·46	2·31	
6	Arithmetic Calculation	210	12	4·84	2·51	
7	Figures (See Thurstone and	135	36	18·31	5·64	Spatial (S)
8	Figures Thurstone, 1941)	135	36	18·53	8·22	
9	Surface Development (Thurstone, 1938)	300	30	10·13	5·23	
10	Letter-Number Similarity	270	90	39·34	9·54	Perceptual Speed and Accuracy (P)
11	Figure-Figure Similarity	120	40	19·81	4·15	
12	Figure-Figure Similarity	120	40	21·79	4·88	
13	Incomplete Pictures	180	12	4·31	2·15	Speed of Closure (Cs)
14	Mutilated Words	150	12	5·20	2·14	
15	Mutilated Words	150	12	7·20	1·82	
16	Letter Series	300	12	6·44	2·55	Reasoning (I) (Mainly Inductive)
17	Letter Sets	150	6	2·78	1·61	
18	Letter Sets	150	6	3·04	1·44	
19	Word-Number Memorisation	240	14	6·06	3·49	Associative Memory (Ma)
20	Figure-Number Memorisation	135	7	3·15	1·90	
21	Figure-Number Memorisation	135	7	3·22	1·80	
22	Physical Principles	180	12	4·31	2·43	Mechanical (Mk)
23	Electrical-Automotive Facts	180	12	3·40	2·48	
24	Woodwork and Shop	180	12	2·36	2·26	
25	Hidden Figures	180	8	3·90	2·24	Flexibility of Closure (Cf)
26	Hidden Figures	180	8	3·34	2·26	
27	Hidden Figures	180	8	2·99	2·20	
28	Digit Span	240	52	36·45	7·22	Span Memory (Ms)
29	Digit Span	240	53	35·90	7·99	
30	Digit Span	240	45	31·66	6·58	
31	Spelling	180	12	6·24	2·71	Spelling (Sp)
32	Spelling	180	12	6·57	2·83	
33	Spelling	180	12	6·06	2·67	
34	Design Preference	180	12	7·16	1·59	Esthetic Judgment (E)
35	Design Preference	180	12	7·43	1·64	
36	Design Preference	180	12	8·68	1·64	
37	Object-Attribute Memorisat'n	160	10	8·05	1·98	Meaningful Memory (Mm)
38	Object-Attribute Memorisat'n	160	10	7·57	2·24	
39	Object-Attribute Memorisat'n	160	10	6·88	2·49	
40	Multiple Object Grouping (Heterogeneous)	300	N/A	6·59	2·45	Originality I (01)
41	Multiple Grouping (Foods)	150	N/A	5·34	1·89	
42	Multiple Grouping (Animals)	150	N/A	4·88	1·80	
43	Attribute Listing—Stimulus I	75	N/A	5·93	2·87	Ideational Fluency (Fi)
44	Attribute Listing—Stimulus II	75	N/A	5·56	2·57	
45	Attribute Listing—Stimulus III	75	N/A	5·10	2·80	
46	Anagrams	180	N/A	18·99	5·89	Word Fluency (W)
47	Anagrams	180	N/A	18·29	5·40	
48	Anagrams	90	N/A	10·66	3·69	
49	Object Synthesis (See Guilford	180	8	3·29	1·69	Originality II (02)
50	Object Synthesis 1971)	180	8	2·93	1·64	
51	Object Synthesis	180	8	3·01	1·55	
52	Aiming	90	N/A	7·17	3·18	Aiming (A)
53	Aiming	90	N/A	7·28	3·63	
54	Aiming	90	N/A	7·29	3·80	
55	Drawing—Straight Lines	180	N/A	4·82	2·53	Representational Drawing (Rd)
56	Drawing—Left-Hand Curves	180	N/A	14·70	5·70	
57	Drawing–Right-Hand Curves	180	N/A	12·26	4·77	

The abbreviations given for the hypothesised primary factors are either those historically used or those given by French *et al.* (1963), in cases where the factor was documented in 1963. Abbreviations for the more recently discovered or tentative primaries are based, generally, on mnemonic appeal, e.g., *Sp*, *E*, *Mm*, 01, 02, and *Rd*. Tests 1 through 39 were in multiple-choice format and were machine-scored. Tests 40 through 57 were in open-ended format and were hand-scored. The open-ended nature of these latter tests explains the 'N/A,' for 'not applicable' under the 'Number of Items' heading in Table 1. Scores on the multiple-choice tests were based simply on the number of items correctly answered; no correction for chance was applied.

It can be seen from Table 1 that most currently known primary factors have been accounted for in the 57 variables listed. A notable exception is the *auditory ability* primary (or primaries), and evidence on this factor will be dealt with elsewhere (Hakstian and Cattell, 1974b).

METHOD

Subjects.

A major consideration was that the sample of subjects be as heterogeneous as possible—without bringing about multimodalities in the variable distributions—in the interests of obtaining maximally discriminable ability factors. Clearly, for the study of fully-developed abilities, two considerations weigh heavily in the selection of subjects: (1) the closer the subjects are to full development of intellect (i.e., adulthood) and (2) the more closely they resemble the distributional characteristics in the population, the better, if an optimally clear portrayal of ability structure is to result. Accordingly, a total sample of 343 subjects was tested on the variables in Table 1, 176 males and 167 females. These subjects, all of whom resided in or near the city of Edmonton, Alberta, comprised the following groups: (1) 160 grade 11 and 12 students, the majority of whom were in non-academic high school programmes; (2) 74 adults in government-sponsored vocational training programmes; (3) 46 airborne artillerymen stationed at a nearby base; and (4) 63 University of Alberta Summer session students. The age range was 15 to 55 years. Two subjects were 15; one was 55. Five persons were older than 49. The mean age was 23·70, the standard deviation, 8·67.

Test administration procedures.

The testing was carried out in the months of May, June and July, 1972. The tests were always given in the same order, that given in Table 1. All subjects were given Tests 1 through 27 (with a 10-minute break after Test 12) in a single morning. The university students and one group of high school students received the rest of the battery the next morning. The other subjects received the rest of the tests in the afternoon of the same day. In all cases, a 10-minute break was given after Test 39. The total testing time, with instructions and breaks, was approximately five hours.

Analysis procedures.

The first analysis procedure consisted of obtaining and inspecting the frequency distribution of scores for each of the 57 variables. The variables, without exception, were distributed without evidence of multimodalities and, except in a small number of cases, in which some distributional truncation occurred (because of either a too low or too high mean), the distributions were symmetric, unimodal, and appeared approximately normal. The 57 tests were next intercorrelated, using the product-moment coefficient, and the 57×57 correlation matrix was subjected to three separate factoring procedures. In the first, a principal components analysis was performed, and the 57 latent roots were plotted and subjected to a scree test (Cattell, 1966). The *a priori* hypothesis of 19 factors appeared reasonable.

Next, in order to address the critically important number-of-factors question from a different perspective, a maximum likelihood common-factor analysis was performed on the correlation matrix. Since it appeared reasonable that some coalescence of *a priori* factorially distinct variables *could* occur (e.g., the Spelling and Verbal, or Originality I and Originality II variables), the hypothesis of 18 common factors was first employed. The chi square value at convergence (χ^2=808·49 ; df=723 ; P> ·02) was statistically significant, indicative of under-factoring. A partially converged 19-factor maximum likelihood solution yielded a chi square value well below statistical significance (χ^2=695·88 ; df=684 ; P> ·35), indicating that at convergence the fit to the data would be even better, and that 19 factors were, indeed, appropriate for the 57 variables.

Finally, using the hypothesis of 19 factors, a common-factor solution was obtained by the unweighted least squares method, and was transformed to an oblique simple structure by several different procedures. The solution obtained by the Harris-Kaiser (1964) independent cluster technique was the cleanest of those obtained and is reported in the next section.

RESULTS AND DISCUSSION

The solution.

The vast majority of the correlations among the 57 variables were positive. Of the few that were negative, not one exceeded the absolute magnitude of ·14, the size necessary to be significantly different from zero at the ·01 level. Positive correlation among ability variables is, of course, a well-established phenomenon. The variable communalities ranged from a low of ·24 (Test 55—drawing straight lines) to a high of ·90 (Test 7—Figures, a spatial ability test), with a mean communality of ·64. This latter figure, of course, indicates that the proportion of the total variance in the 57 variables designated common-factor variance was ·64.

The primary-factor pattern matrix—the most interpretable 'factor loading matrix' in the case of an oblique solution—for the 57 variables and 19 common factors is given in Table 2. The 'H-Count' tabulation in Table 2 stands for 'hyperplane-count,' or, operationally, the number of primary pattern coefficients on the factor hyperplanes—defined (arbitrarily) as the range 0±·10. Pattern coefficients larger than ·30 have been noted, and these 'salient' coefficients form the basis of the factor interpretations discussed shortly.

It can be seen from Table 2 that the primary pattern is unusually clean with a total H-Count of 952, or a *per cent hyperplane* of 88 per cent. The primary pattern, then, provides strong evidence for confirmation of the initial hypothesis regarding the discriminability and clarity of resolution of both the long-established and the more recently hypothesised 'primary mental abilities' —the 'agencies' or *a*'s in Cattell's (1971) Triadic Theory of ability structure.

TABLE 2

OBLIQUE PRIMARY-FACTOR PATTERN (DECIMAL POINTS OMITTED).

	Factor																			
Vari-	V	N	S	P	Cs	I	Ma	Mk	Cf	Ms	Sp	E	Mm	01	Fi	W	02	A	Rd	
able	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	h^2
1	43	08.	04	-06	02	-25	-01	07	02	04	28	-04	03	00	15	04	04	03	02	62
2	70	01	07	03	-04	-11	03	-01	-06	-02	02	16	06	10	-04	-02	06	01	-07	65
3	71	-09	-10	00	06	27	00	04	03	03	-12	-21	-10	-01	-04	-03	-03	-03	11	43
4	01	85	-05	01	-02	11	00	00	04	-02	-01	-04	01	04	01	00	-02	-02	05	84
5	01	99	-03	-02	01	-05	-03	-04	-02	06	00	01	01	03	-08	00	02	01	-01	88
6	-01	85	06	04	-05	-04	05	10	00	-04	02	01	-04	-03	08	02	-01	00	-03	81
7	-03	05	100	01	-02	-07	-05	-05	-01	02	-01	-03	04	00	-01	04	01	-04	01	90
8	02	-08	92	05	-04	02	01	03	-02	-01	03	-04	-06	02	02	03	00	01	-01	83
9	07	03	35	-10	18	23	07	13	07	-03	-10	09	03	01	-04	-18	-05	06	09	60
10	-09	23	05	46	13	-03	-07	-16	-03	08	-02	02	06	01	00	08	00	10	-08	49
11	-01	-05	-02	96	-04	-01	-01	05	00	02	08	-02	-01	-01	-04	-04	00	-06	08	84
12	06	-04	01	92	01	04	07	04	02	-06	-07	01	-04	-02	02	-01	-01	01	00	88
13	02	-12	-03	10	41	-20	-11	02	10	00	-04	01	15	-02	04	12	12	-03	-05	28
14	-09	-03	02	-02	69	09	06	01	01	00	13	-06	-05	02	00	00	05	-02	02	59
15	09	02	-03	02	84	04	-03	-04	-07	-01	-02	03	00	-05	00	01	-08	02	-07	65
16	08	09	05	01	20	43	02	-06	02	07	-05	11	02	08	-04	-10	-05	00	02	59
17	-02	00	00	04	-06	77	02	03	08	-01	00	-02	05	03	-02	04	-01	-02	-05	66
18	-08	-04	-04	-05	-04	89	-06	05	-05	01	09	-06	-04	00	01	11	05	02	05	67
19	-01	05	-04	10	-12	04	72	-05	-01	-06	03	-03	08	-03	04	-03	09	-03	-07	56
20	-11	-06	-03	-03	02	-13	85	09	08	-01	03	01	-04	14	02	04	-04	02	02	71
21	12	03	06	-06	07	08	65	-07	-06	08	-04	01	01	-11	-07	02	-04	01	01	52
22	-04	08	05	-02	17	22	00	60	-01	-02	00	05	00	07	04	-09	-06	-04	-02	64
23	01	06	-02	02	-12	-03	-10	83	01	01	-03	-08	07	-09	03	12	06	03	-08	72
24	07	-06	00	-01	-05	-12	05	83	-01	00	02	06	-04	-05	-08	-01	01	01	04	70
25	-02	-01	-06	04	03	00	06	00	83	03	00	-04	-09	04	00	-05	07	01	05	76
26	03	-01	-02	02	-01	05	-02	00	92	00	-03	-01	03	-03	07	02	-09	-01	00	85
27	-02	03	08	-06	00	-02	-04	-01	91	-03	03	05	04	-03	-06	03	02	00	-03	83
28	00	-11	00	06	-19	08	-08	-02	04	81	11	-01	11	09	00	03	00	-04	-03	68
29	-09	02	02	-04	14	-11	06	04	00	87	-03	00	-05	-06	05	-02	01	00	01	77
30	10	06	-02	00	02	07	02	-03	-04	78	-08	02	-05	-06	-03	00	-01	02	01	66
31	01	-04	-03	00	10	-10	05	10	05	04	83	-02	-06	09	04	-03	-06	01	-04	75
32	01	03	04	00	-02	06	03	-01	-02	-03	87	-04	04	-04	03	-04	02	01	-01	77
33	04	02	-02	00	-01	07	-07	-10	-02	-03	82	07	00	-05	-11	05	02	-02	06	71
34	07	01	-07	-03	08	-10	-01	05	01	03	-10	57	-04	11	-16	04	-01	01	06	34
35	-06	-03	-03	03	-07	00	-04	01	03	01	11	66	02	-02	08	06	-04	-02	04	47
36	-06	-04	10	01	-05	34	06	-02	-07	-01	-01	39	-01	-18	20	-15	13	-03	-09	34
37	09	03	12	-05	-01	-08	06	-07	00	-02	-01	07	71	-07	-05	01	02	00	-03	56
38	-02	04	-07	02	06	03	-06	-01	01	02	00	-11	81	04	-04	-04	06	00	02	64
39	-06	-09	-07	02	-01	09	05	11	-04	00	00	02	72	03	07	02	-09	01	06	61
40	06	05	01	-07	02	-08	08	-09	05	01	-12	04	-03	58	-04	00	13	01	09	50
41	03	07	03	-02	01	10	-06	-08	-01	-11	05	00	05	61	07	03	-05	-02	-04	54
42	-02	-06	-02	06	-09	07	-03	09	-05	07	05	-02	-02	81	03	-01	-03	01	-04	59
43	-04	00	03	-04	-13	02	-01	-02	03	04	08	01	-01	02	70	00	05	06	-04	52
44	-08	02	-06	-01	16	-07	-03	05	00	00	-05	06	00	09	69	-04	02	04	-01	57
45	18	-01	01	04	01	01	02	-04	-03	-03	-09	-07	-01	-07	79	05	-07	-08	08	64
46	01	-02	05	-07	-01	04	06	-02	-01	00	04	-05	-01	-07	02	87	-03	01	06	78
47	07	-03	-03	04	-02	13	01	-04	-02	-04	-03	08	-05	-01	-07	85	06	03	-01	81
48	-08	06	00	03	09	-10	-04	07	02	04	-03	00	04	09	04	70	-02	-03	-05	57
49	03	02	07	-02	06	-05	-06	05	04	00	-02	00	-02	06	-11	-07	71	08	-06	51
50	-12	06	-02	-01	02	11	05	00	-02	02	04	-08	-01	-09	06	00	77	-02	06	60
51	12	-09	-06	02	-03	-04	02	-04	-01	-02	-03	07	02	06	07	08	55	-06	03	46
52	-04	-10	06	00	-01	-05	05	02	06	06	02	-04	-01	08	-04	00	-10	84	-05	71
53	03	03	-02	02	01	06	-01	00	-03	-06	-04	02	-05	-04	05	-03	03	91	03	83
54	01	04	-04	01	-01	-01	-03	-02	-03	-01	02	01	06	-04	02	03	05	80	05	69
55	20	12	-03	-05	-06	05	-02	-10	06	-04	-01	07	02	-25	05	02	-06	04	38	24
56	07	-05	03	08	-13	04	-04	-07	05	02	01	03	06	04	-01	-02	05	05	58	48
57	-21	00	02	-03	13	-10	02	11	-08	01	01	-04	-03	09	-01	00	00	-05	89	66
H-Count	47	50	53	54	42	41	53	50	54	53	48	50	52	49	49	49	51	54	53	

The matrix of intercorrelations among the 19 primary factors is displayed in Table 3.

TABLE 3

CORRELATIONS AMONG PRIMARY FACTORS.
(Decimal Points Omitted)

	V	N	S	P	Cs	I	Ma	Mk	Cf	Ms	Sp	E	Mm	O1	Fi	W	O2	A
N	51																	
S	32	39																
P	18	35	49															
Cs	47	45	42	39														
I	32	53	56	39	55													
Ma	30	33	22	27	42	44												
Mk	40	29	30	11	21	22	-03											
Cf	35	39	47	36	49	53	31	22										
Ms	30	37	32	30	34	36	28	16	24									
Sp	52	46	08	13	51	22	36	-04	19	24								
E	41	32	30	31	52	48	31	17	36	28	29							
Mm	36	29	23	30	44	41	58	07	28	20	35	33						
O1	49	47	37	26	47	52	41	05	38	23	38	41	40					
Fi	51	38	14	14	41	34	24	07	22	22	39	42	31	51				
W	41	45	23	18	61	39	35	02	28	22	59	33	31	51	45			
O2	44	26	17	07	40	25	27	26	29	18	17	32	31	43	43	40		
A	20	26	25	25	31	27	31	-04	31	15	25	18	37	25	19	23	13	
Rd	35	27	38	27	34	42	28	12	54	13	24	43	32	43	33	25	30	39

The factors.

The first factor in Table 2 is a clear manifestation of what has been referred to, in the past, as 'Verbal Ability' or 'Verbal Comprehension.' The Verbal or *V* factor has, over the years, been extremely resistant to fragmentation into subfactors (see Carroll, 1941 ; French, 1951), except in the analyses of Guilford and his co-workers (see Guilford and Hoepfner, 1971), analyses which are methodologically somewhat different from the Thurstonian simple structure-motivated multiple-factor analysis. The Verbal factor is concerned with the understanding of words and ideas expressed in the English language. The tests used in the present study—(1) finding synonyms for given words ; (2) extricating the meaning from (often archaic) proverbs ; and (3) completing verbal analogies—are those that, over the years, in countless researches, have consistently marked this factor. Many other tests, such as those involving sentence completion, paragraph reading, antonyms, and word classification, have also loaded on this factor. It can be seen that Verbal ability, as here described, is factorially distinct from Spelling (*Sp*—factor XI), Word Fluency (*W*—Factor XVI) and Ideational Fluency (*Fi*—Factor XV), the latter two factors being concerned with the *production* rather than *comprehension* of, respectively, words and ideas. Verbal ability may be the best single contributor to traditionally defined general intelligence or 'g,' and appears to have greatest saliency for Cattell's higher-order Crystallised Intelligence construct (Cattell, 1963, 1967a, 1967b ; Horn and Cattell, 1966).

Factor II, *N* is the Numerical ability or Number factor, and is concerned with facility in manipulating numbers, i.e., tasks requiring addition, subtraction, multiplication, division, squaring, and so on. This function is factorially distinct from both (1) arithmetic reasoning (tests of which tend to load on *N*, as well as both *I* (induction), and a deductive reasoning factor when it is found) and (2) mathematical knowledge (tests of which tend to have a high V component), as is revealed in Dudek (1948), Thurstone (1938, 1940), and Thurstone and Thurstone (1941).

The third factor is the Spatial or S factor. This function concerns the ability to visualise two-(Tests 7 and 8 in the present study) and three-dimensional (Test 9) figures when their orientation in a plane or space is altered. French (1951) distinguished among 'Space,' 'Spatial Orientation,' and 'Visualisation' primaries, but there appears to be little evidence for this distinction, particularly between 'Space' and 'Spatial Orientation.' There is evidence (Horn and Cattell, 1966) that Visualisation is much broader than the primary factors, involving, in addition to what we are referring to as Spatial ability, certain other primaries in the perceptual and motor domains. It is clear from Table 2 that the Surface Development (Test 9) task (see Thurstone, 1938) has some factorial complexity not found with the purer Spatial variables, such as Figures, 'Cards,' 'Flags,' etc. (Thurstone and Thurstone, 1941). The pattern coefficient of ·23 for Test 9 on Factor VI—Inductive Reasoning—is the most notable example of this complexity, and is not surprising in that the Surface Development task requires a certain amount of a sort of 'figural reasoning,' being a much more complicated task than the Figure Tests.

Factor IV, P, is the Perceptual Speed and Accuracy primary, and involves making rapid assessments of visual stimuli, usually to determine the sameness or difference of the members in pairs of such stimuli. The early work of Thurstone (1938, 1940, 1944) and Thurstone and Thurstone (1941) failed to demonstrate this ability as factorially distinct from such other, more recently substantiated, perceptual primaries as Speed of Closure (Cs) and Flexibility of Closure (*Cf*), but more recent research (e.g., Pemberton, 1952) has shown the latter two factors as distinct from P. In the present study, Test 10 involves rapidly assessing the similarity or dissimilarity of pairs of letter or number sets, whereas Tests 11 and 12 involve the same task with figures. Although Tests 11 and 12 are factorially pure for P, Test 10 has some, albeit small, variance in N, suggesting that simple familiarity with numbers may have a small effect on both N and P, when the latter is measured this way.

Factor V is the Speed of Closure, or *Cs*, primary, and involves the ability to complete the gestalt when parts of the stimulus are missing. Referred to as 'Gestalt Perception' in French (1951), this factor was not found in Thurstone's (1938) early work (before the perceptual abilities were differentiated), was later found but contaminated with the *Cf* (Flexibility of Closure) factor by Thurstone (1944), and was definitively discriminated by Botzum (1951) and Pemberton (1952). Although we have preferred to treat this factor as unitary, there is some evidence (Pemberton, 1952) for discriminating between a 'verbal closure' factor and Speed of Closure. The higher correlation between the two Mutilated Words tests (14 and 15) than between each and the Incomplete Pictures test (13) suggests that 'speed of *verbal* closure' may be, to a small extent, dependent on word familiarity. The rather high correlations of *Cs* with V, *Sp* (Spelling—Factor XI), and W (Word Fluency—Factor XVI)—·47, ·51 and ·61—respectively, strengthen this conclusion.

In Factor VI we have the Inductive Reasoning, or I, primary. This factor theoretically involves only the process of induction, or reasoning from the specific to the general. The tests used in this study to mark I involved Letter Series (Test 16) and Letter Sets (17 and 18), the latter tests (modelled after Thurstone and Thurstone's, 1941, Letter Grouping) requiring the subjects to determine which set of four letters was different from the other four sets, which had a rule in common. These tests require mainly induction, and this factor can be seen as distinct (logically and factorially) from a Deductive Reasoning primary (see Pawlik, 1966). The authors prefer to consider the General Reasoning factor discussed by French *et al.* (1963) not as a primary ability, but rather as an incomplete manifestation of the higher-order Fluid Intelligence (see Cattell, 1963) function. It is interesting to note that several other tests load on *I* to some extent, with one test (36), in addition to those marking the factor, having a pattern coefficient larger than ·3 (·34). This test involves esthetic preference and design perception, and no compelling reason can be given for its dependence on *I*. It is likely true, however, that many intellectual tasks—other than those specifically designed to measure *I*—have some dependence on this factor (the loading of ·27 by Verbal Analogies should not be surprising in this light).

The next factor is Associative (or Rote) Memory, or ***Ma***, and concerns the ability to recall units in pairs, for which no clear mediating link between pairmates exists. In the present study, this factor was represented by one test (19) involving word-number pairs, and two (20 and 21) with figure-number pairs. It is interesting to note that the two test correlations involving Test 19 (word-number) with each of the other two ***Ma*** tests (figure-number) are ·59 and ·49—values not significantly different from the figure-number correlation (Tests 20 and 21) of ·57. This finding calls into question, somewhat, Guilford's (1967) insistence on the orthogonality of memory factors between the figural and symbolic stimulus domains, although, in fairness, it should be noted that in all three tests in the present study, the responses called for were symbolic (numbers). Nonetheless, a symbolic, on the one hand, and figural, on the other, stimulus formed an integral part of the memory bonds. A rather undifferentiated memory factor appeared in the earlier research of Carroll (1941, 1943), Garrett (1938), Thurstone (1938, 1940), and Thurstone and Thurstone (1941), with ***Ma*** confounded with a Span Memory factor (*Ms*, in the present study) in Garrett's study. It remained for Kelley (1964) to separate out three clear memory factors: ***Ma***, ***Ms*** and ***Mm*** (Factor XIII, Meaningful Memory in the present study).

Factor VIII is the Mechanical Ability, *Mk*, factor, and should probably be referred to as either 'Mechanical Knowledge,' or, as it is by French (1951), 'Mechanical Experience,' involving as it does, knowledge of physical principles, tools, electrical and automotive facts, and so on. This construct has a long history, being first systematically studied by Cox (1928), and has been used to predict success in certain occupations for nearly as long. Although *Mk* appears as a relatively unitary factor in Table 2, it is probably appropriate to consider it less as a unitary primary 'ability,' and more as an amalgam of other, more basic, abilities in the reasoning, spatial, and perceptual areas, along with a rather large experiential component.

Factor IX is Flexibility of Closure, or *Cf*, and involves penetrating or disregarding irrelevant stimuli in a perceptual field to find stimulus figures. Thurstone's (1944) study revealed a factor described as 'perceptual flexibility' with high loadings by Hidden Pictures and the Gottschaldt Figures, this factor being distinct from the *Cs* primary (although the Gottschaldt Figures tests had loadings on both the *Cf* and *Cs* factors). French (1951) referred to this factor as 'Gestalt Flexibility,' and Botzum (1951) and Pemberton (1952) isolated it as a distinct perceptual factor. In the present study, Tests 25, 26 and 27 were designed to be somewhat like the Gottschaldt Figures, and varied somewhat in difficulty. This factor appears to be a manifestation of Witkin's (1962) 'field independence' construct, and to be related to the personality factor, Independence (see Cattell, 1971).

Factor X is Span Memory, or *Ms*, and involves the short-term retention of meaningless stimulus strings, e.g., in the present study, auditorily presented digit strings varying in length from five to 10. This task has a long history, being part of the Stanford-Binet test, the older Wechsler-Bellevue Scale and the later WISC and WAIS and, as has been noted, was considered dependent upon a more general memory factor in early research. Kelley's (1964) study, however, showed *Ms* to be distinct from the other memory factors, and the present results tend to confirm this fact. Interestingly, the ***mean*** (over nine correlations) *r* between the three *Ms* tests and the three *Ma* tests is a low ·18; that between the three *Ms* and three *Mm* tests, ·13. As can be seen from Table 3, *Ms* correlates only ·28 with *Ma*, and only ·20 with *Mm*. Whether some of the distinction between *Ma* and *Ms* stems from presentation modality (the former traditionally visual; the latter, auditory) is not fully clear at this time. It may well be that Digit Span tests have little to do with our common conception of memory, but rather involve a more attentional mechanism that exhibits individual differences in simply keeping a range of stimuli in immediate awareness.

Factor XI is Spelling, or *Sp*, and involves—at least in the present study—the ability to recognise misspelled words. It is assumed that this ability is the same as (but more easily measured than) that of correctly spelling dictated words. Spelling has not been isolated previously as a unitary factor, but this is largely because Spelling tests have been included, in the past, in factor analyses as single variables, so that no common factor could emerge. In such studies (e.g., Carroll, 1941 ; Thurstone, 1938, 1940 , Wittenborn and Larsen, 1944), the single Spelling variable has shown considerable factorial complexity, loading on not only the *V* factor found, but also, in several cases, on the *W*, or Word Fluency factor (Factor XVI in the present study). The correlations, in the present study, between *Sp*, and Factors *V* and *W* are, respectively, ·52 and ·59. Whether Spelling should be regarded as a relatively narrow primary ability, or, instead, as a specific behaviour dependent upon both the *V* and *W* primaries, and perhaps others, is not yet clear.

The next factor from Table 2 is Esthetic Judgment, *E*, involving the ability to detect the manifestation of basic principles of good art or design. In the present study, some test items were concerned with detecting the one design, from three, that showed balance, unity, movement, and so on. In others, the subjects were simply asked to indicate a preference among designs. Although some work has been done on measuring artistic promise (e.g., the Graves and Meier tests), the authors have yet to find any systematic factorial research in this area. We may be dealing with a rather complex construct here, as with *Mk*, involving, perhaps, a combination of primary abilities, and an experiential component.

Factor XIII is Meaningful Memory, *Mm*, and is involved in the remembering of pairs in which a meaningful link exists between pairmates. In the present study, three tests (37–39) were given in which concrete objects were paired with reasonable descriptors. With a two-minute delay between list and test (with intervening material), the task differed from the *Ma* task in both the link between pairmates and the required duration of retention. Kelley (1964), as has been noted, found evidence for discriminating an *Mm* from an *Ma* factor, using tests somewhat similar to those in the present study. That the tests and factors are certainly not statistically independent is indicated by: (1) correlations between the three *Ma* tests and the three for *Mm*—the ***mean*** correlation (over the nine obtained) is ·35, as opposed to a mean *r* among the three *Ma* tests of ·55 and among the three *Mm* tests of ·57 ; and (2) the correlations between the transformed *Ma* and *Mm* factors of ·58. The present results, however, seem to suggest that *Ma* and *Mm* are behaviourally distinct functions, although the underlying mechanisms are far from clear. Proceeding from Cattell's (1971) discussion of this point, the authors suspect that a more general underlying *retention* capacity is overlaid by individual differences in the effectiveness of the *committing* to memory, the latter function differing (for all subjects), according to the meaningfulness and concreteness of the material to be remembered.

We have referred to Factor XIV as Originality I, or *O1*, in the present study, simply because it is the first of two originality or ideational flexibility constructs examined. The tests used (40–42) were patterned after the Multiple Grouping test devised by Guilford (see Guilford and Hoepfner, 1971), who saw the task as one involving ' Spontaneous Flexibility,' the latter trait translating into the Divergent Production of Semantic Classes (DMC) cell of the Structure of Intellect design. In the present study, Test 40 involved grouping of heterogeneous objects · Test 41, of foods ; and 42, of animals. Although it was suspected prior to the study that the *O1* variables would define the same factor as those for Originality II (*O2*) and, perhaps, even those for Ideational Fluency (Fi), this did not occur and, although the interfactor *r*'s are substantial—that for *O1* with *O2* is ·43 ; for *O1* with *Fi*, ·51 ; and for *O2* with *Fi*, ·43—the test correlations within each of these clusters are substantially higher than those between, indicating the existence of discriminable factors.

Factor XV is Ideational Fluency, *Fi*, and is characterised by the ability to produce ideas about a given topic, rapidly and without attention given to quality. In the present study, Tests 43-45 each consisted of having the subjects list as many adjectives as they could, in a fixed time, that could reasonably describe a given stimulus. This function is logically and empirically distinct from Word Fluency, (*W* described next), and may be distinguishable from two additional fluency factors (not included in the present study) discussed by Guilford (1971)—Associational Fluency (involving production of synonymous or non-synonymous word associations) and Expressional Fluency (involving production of verbal expressions for given themes). These latter factors are dealt with by French *et al.* (1963). Ideational Fluency has been fairly well established in such earlier studies as those by Bechtoldt (1947), Cattell and Tiner (1949), and Taylor (1947).

Factor XVI, Word Fluency, or *W* is concerned with the rapid production of words—generally conforming to certain letter requirements—without a *meaning* component entering into the task. In the present study, Tests 46–48 were of the ' anagrams ' variety. The Word Fluency factor has a long history, having been found in such early research as that by Cattell (1933), Fruchter (1948), Studman (1935), Taylor (1947), Thurstone (1938), and Thurstone and Thurstone (1941), and in the more recent research of Guilford (documented in Guilford and Hoepfner, 1971).

We have named the next factor Originality II, or *O2*. As with *O1*, this factor represents a relatively new construct, and the extent to which its factorial boundaries extend beyond the Object Synthesis form of test is not fully known at this time. The tests used in the present study (49–51) were modelled after a test described by Guilford and Hoepfner (1971), in which subjects are asked to combine two common objects to make a new functional object. This task obviously involves some set-breaking flexibility, in addition to a certain degree of originality and synthesis. The test was originally designed to mark Guilford's ' Convergent Production of Semantic Transformations ' (NMT) factor, although, interestingly, its presence was noted on a *divergent* production factor (DMT)—Guilford's ' Originality ' factor—at a later time (see Guilford and Hoepfner, 1971). French *et al.* (1963) identified this test with a Semantic Redefinition (*Re*) factor (Guilford's NMT). One possibility, suggested by the ' synthesis ' nature of the task, is that *O2* may well represent—analagous to the *perceptual* closure factors—a sort of *ideational closure* function.

Factor XVIII is Aiming, or *A*, and involves the carrying out, under highly speeded conditions, of precise movements requiring eye-hand co-ordination. In the present analysis, Tests 52-54 required the subjects to draw pencil lines between narrowly spaced lines in the form of boxes. The existence of this factor has been known for some time, and has appeared in earlier analyses using somewhat similar tests, e.g., studies by Greene (1943) and by Chapman (1948) and Goodman (1947), the latter two studies involving the MacQuarrie Test for Mechanical Ability.

The final primary factor in the present study is Representational Drawing ability, or *Rd*. The defining tests (55–57) required the subjects to draw, as accurately as possible (but with ample time), a picture of each of several stimulus objects presented. The drawings were scored for precision of the (1) straight lines, (2) left-hand curves, and (3) right-hand curves required. Although there has been the occasional discussion of the relationship between drawing ability and intelligence (e.g., Burt, 1940) and one or two instances of test development interest, little systematic factorial work has been done with this construct. It may be true that *Rd* is—like *Mk*—rather too complex to be considered at the same level of taxonomic and behavioural generality as the other ' abilities ' we have discussed, and instead represents a complex interaction of certain perceptual and motor abilities (but not necessarily a higher-order factor). The interfactor *r* of ·54 for *Rd* and *Cf* supports the hypothesis of some association with perceptual (closure) processes, and the ·39 for *Rd* and *A*, of some motor dexterity association. The *r* of ·43 for *Rd* and *E* may be suggestive of a general artistic ' cluster.'

Relationships among the factors.

In the earlier discussion of the factors, interfactor correlations were discussed in many instances, for interpretive purposes. In this section, the correlations among five of the most long-established factors—*V*, *N*, *S*, *I* and *W*—are re-examined. Specifically, the interfactor *r*'s for these abilities are compared to those *r*'s—for the same factors—in the two analyses reported in Thurstone and Thurstone's (1941) monumental study. The purpose of this comparison was to assess the positioning, in common-factor space, in the present study, of these well-established primaries, relative to that in the earlier study.

Two independent samples were used in the Thurstone and Thurstone (1941) study: (1) 710 grade 8 students given a 60-variable battery, and designated here the ' 60-V ' sample, and (2) 437 grade 8 students given a 21-variable battery, and designated here the ' 21-V ' sample. The 10 interfactor *r*'s (among the five factors) for these samples and the present ones were converted to Fisher's z_r's and the pairwise differences were tested for statistical significance, using the ·01 level throughout.

TABLE 4

Correlations Among Five Primary Factors in the Present Study and Those in the Thurstone and Thurstone (1941) Study, and Results of Significance Tests on the Differences Between the Correlations in the Three Analyses

	Correlations Analysis			Differences between Correlations Comparison		
Factor Pair	Present	60-V[a]	21-V[b]	Present *vs* 60-V	Present *vs* 21-V	60-V *vs* 21-V
V and N . .	·51	·35	·39	P<·01		
V and S . . .	·32	·38	·17			P<·01
V and I . . .	·32	·42	·55		P<·01	P<·01
V and W .	·41	·42	·51			
N and S .	·39	·12	·26	P<·01		
N and I . .	·53	·24	·54	P<·01		P<·01
N and W . .	·45	·33	·47			P<·01
S and I .	·56	·43	·39	P<·01	P<·01	
S and W . .	·23	·27	·17			
I and W .	·39	·32	·48			P<·01

[a] Thurstone and Thurstone's (1941) 60 variable sample
[b] Thurstone and Thurstone's (1941) 21 variable sample.

It can be seen from Table 4 that in four comparisons between the present factors and the 60-V factors, the *r*'s were significantly different. In only two cases, however, of the 10 factor pairs, did the present *r*'s differ from the 21-V *r*'s, and in only one of these, was there a difference between the present and corresponding 60-V *r* (the *r* between *S* and *I* was significantly higher in the present than in the earlier studies). On the other hand, five of the 10 *r*'s were significantly different between the 60-V and 21-V analyses, indicating that the interfactor *r*'s for these five factors, at least in the present study, are at least as close to those in the two earlier studies as those in the earlier analyses were to one another.

There are good reasons, of course, for differences in interfactor correlations between the earlier and present studies. One reason is simply the difference in age of the subjects involved. Perhaps more important, though, is the difference in variability between the samples. Thurstone and Thurstone's (1941) samples were homogeneous as to age and educational level, whereas the present subjects were heterogeneous as to these variables and, likely, many others. It seems clear, however, that, despite the influences noted that might be expected to produce differing degrees of relationship among the axes, the present factor alignments—at least for the five primaries considered here—are generally in agreement with those arrived at in earlier research.

CONCLUSIONS

The purpose of the present study was to assess the differentiability and mutual relationships of 19 constructs believed to be of the order of generality of primary mental abilities. Such better known primaries as Verbal, Numerical, Spatial, Perceptual Speed, Speed and Flexibility of Perceptual Closure, Inductive Reasoning, Word Fluency, and Aiming were isolated as factorially distinct constructs. Such more recently hypothesised primaries as distinct Associative and Meaningful Memory factors, Span Memory, Ideational Fluency and two ideational flexibility factors were found as distinct constructs, and four factors (Mechanical, Spelling, Esthetic Judgment, and Representational Drawing) were isolated that, although factorially distinct in the present study, may represent combinations of certain more basic traits.

The broadness or specificity of a construct and, indeed, its conceptual status in the hierarchical schema of a content domain is, of course, quite dependent upon the breadth or narrowness of the variables defining it in factorial studies. With some of the primary factors found in the present study, the breadth of performance—within the hypothesised boundaries of that construct—is such that there is little doubt about the place of the construct in the ability domain. In some cases, however, further work is needed to determine the breadth and place of the construct relative to other ability factors. Because a major concern in the overall project of which the present study was a part was to explore the higher ability strata, with primary factors marked in some cases by what were believed to be the one or two most effective measures of the factors, several of the first-order ability factors reported may have slightly less generality than our common notion of a ' primary mental ability ' (*O2*, *Fi*, *W* and *Cf*, perhaps, although the latter three have been clearly identified, factorially, in the past), or slightly more (*Mk*, *Sp* and *Rd*, perhaps for the reasons noted earlier). What is of interest from the preceding findings is that in the context of a very broad set of performances, the earlier-established primary mental abilities have emerged in relatively identical form to that found in the past, and against this back-drop of varied performances, some newer abilities have been confirmed, at least as worthy of more extensive investigation.

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CÓGNITIVE DEMAND AND DIFFICULTY OF GCE O-LEVEL MATHEMATICS PRETEST ITEMS

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SUMMARY 720 mathematics O-level items from pretests written for two different syllabuses were assessed for ' concrete ' or ' formal ' demands by two judges, using criteria derived from Piaget's theory of cognitive development. The mean difficulty indices for items placed in concrete and formal categories were compared in order to test the hypothesis that items classified as making higher demands would be found more difficult. Results showed that, while there was some variability, there was significant agreement between the judges ($P < \cdot 001$) in the placing of the items and a significant correlation ($P < \cdot 001$) between classification category and the difficulty index of the items An unexpected difference between the two syllabuses in the distribution of items over concrete and formal categories was also discovered.

Several possible interpretations of these results are briefly discussed, and also ways of making criteria for formal and concrete operations more rapidly applicable to such mathematical activities as the solution of multiple choice examination items.

INTRODUCTION

ANY useful theory of cognitive development (indeed, any useful theory at all) must satisfy the condition that it be testable, which in turn requires *reproducibility* of results obtained under clearly specified experimental conditions, and *applicability* of the theory to new situations to make predictions which can be checked empirically. These two conditions of testability are necessary but may not be sufficient. Those who agree with Popper (1968) will insist that a third condition, *falsifiability*, is required for sufficiency.

There have been many studies aimed at checking the reproducibility of Piaget's experimental findings (e.g., Pinard and Laurendeau, 1969; Lovell, 1959, 1961) and some attempts to falsify his theory (e.g., Bryant and Trabasso, 1971). However, few with the exception of Shayer (1972) have tried to make a systematic application of Piaget's theory, including his distinction between concrete and formal reasoning, to the secondary school curriculum and none, so far as we know, to secondary school mathematics curricula. Probably the chief reason for this is that it is difficult to formulate criteria for distinguishing between concrete and formal thought which are at the same time sufficiently general to be widely applicable, and yet sufficiently particular to be applicable in detail to whatever example of intellectual activity in secondary school mathematics pupils may be called upon to do. The work reported in this paper was an attempt to formulate such criteria and apply them systematically to mathematical activities for which an objective measure of difficulty was independently available. GCE O-level mathematics multiple choice pretest items were chosen for this purpose, statistical indices of difficulty for them having been obtained separately by the Examination Board. The hypothesis to be tested was that, as formal thinking makes severer demands than concrete thinking, items classified by us as ' formal ' would be found to be significantly more difficult, as measured by difficulty indices, than those classified as ' concrete.'

This comparison of the difficulty indices of the items so classified thus constitutes an empirical test of the model from which our assessment criteria were derived and, therefore, albeit somewhat indirectly, a test of the applicability of Piaget's theory to material of this kind.

METHOD

(i) *Statement of criteria.*

In order to formulate applicable criteria we first of all made a re-statement as follows of the description Piaget gives of the difference between the concrete and formal stages of cognitive development using, in particular, Inhelder and Piaget (1958).

Concrete operations.

According to Piaget, concrete operations constitute interiorised (mental) activities which correspond to physical actions which we can do, or imagine ourselves doing, upon objects or systems of objects in problem or other manipulative situations in the real world. ' Concrete operations ' does not refer only to the direct (physical) actions themselves on material objects (a common misunderstanding) but to the mental structures and plans which lie behind the actions. It is necessary to postulate some means by which the concrete operational thinker can represent to himself, either internally in his head or by means of material analogues, diagrams or words, the physical situations on which he could operate. It is convenient to call such representation, whether mental or material, a concrete model. The term is borrowed from Robert Karplus although we are using it here in a way different from his. An essential feature of a concrete model is that it must be an image of the situation modelled, i.e., there must be a one-to-one mapping of the relevant aspects of the model on to the physical situation which is modelled. (As we shall presently show, concrete models are not the only forms of representation which can support thinking.) A model railway, a set of plans of a building, a child's drawing of a dog, an eye witness description of a car crash are all concrete models in our sense. The concrete operational thinker can sort and classify physical objects on the basis of specified relations or sets of attributes and as a result can carry out some mathematical operations with the natural and rational numbers and with integers.

The fully operational (concrete) thinker has built up a working knowledge of the physical properties of material objects, including the ' conservations ' or ' invariances ' (e.g., of number, length, ' quantity ' of solid or liquid, weight, horizontal/vertical). He can interpret perspective drawings and makes use of perspective in his own drawing. For a fuller review of these developments, see Fogelman (1970) or the Nuffield Mathematics Project's Checking Up guides (1972).

Formal operations.

One of the key differences between concrete and formal operations lies in the nature of the data which the thinker has to handle and the kind of model available to support his thinking. Whereas an important characteristic of the data which can be processed by a thinker using concrete operations is that it can be represented by a concrete model, this kind of representation is no longer necessary for a thinker able to use formal operations. A ' formal ' thinker can handle non-intuitable data, and what is essentially involved here that is different from concrete thought is working with second order relations, that is, handling the relationships which may or do subsist between the *relations* between intuitable data. For example, a simple ratio may express the relation between numerical values of two quantities characteristic of a physical system (e.g., 3 metres of ribbon for 5 pence, 3 tons of sand for £5, etc.) but a *proportion*, which is an equivalence class of ratios, expresses a relation (in this case equivalence) between the ratios, which are themselves relations. This relationship between the ratios is not normally expressed in the form of whole sets of concrete models, but the representation is frequently *compressed,* say into the form of a straight line graph with an equation $3y=5x$, which is intended to represent the relations between *all* possible ordered pairs of numbers which define the relation concerned. The use of a pseudo-spatial diagram such as a straight line graph necessarily represents the data at one remove from the whole set of concrete situations which they represent. Accordingly, we may call such a diagram a formal model.

A further important characteristic which distinguishes formal from concrete thinking is concerned with the direction in which thought tends. The concrete operational thinker can start from the real world and make (concrete) models of non-real but logically possible systems, but in general he does not work in the opposite direction, i.e., by considering whole sets of possible cases and singling out suitable actual ones for consideration or some sort of test. This, however, is what the thinker using formal operations does do. Whereas using concrete operations his thought goes from the real to the possible, using formal operations the direction is from the possible to the real.

This ability to order and examine systematically the set of all possibilities which *may* be relevant to the understanding of a situation, Piaget calls the use of a combinatorial system. Such a ' hypothetico-deductive ' approach to any system affected or controlled by a number of variable factors demands the ability to deal with the likely relevant factors systematically, i.e., deliberately to hold all but one factor constant and study the effect of varying just that one ; to do this successively with each factor in turn ; and, if the situation seems to require it, to put together the effect of several factors. Ultimately, it is necessary to build up an overall picture of the way in which all of the relevant factors enter into the situation. The formal thinker, therefore, has available a whole new repertoire of more powerful schemata which are inaccessible to the concrete thinker, including those of combinatorial operations, proportionality, probability, and correlation. For a full list see Inhelder and Piaget (1958). In addition he has the ablity to use formal models.

Application of criteria for ' concrete ' and ' formal ' demands.

Several approaches are possible to the application of Piaget's theory in the assessment of cognitive demand. A strict application would be limited to those intellectual activities which patently have all the characteristics which Piaget specifically describes, such as the sorting of objects according to two attributes simultaneously at the concrete level, or the use of the proportionality schema at the formal. There are, however, many mathematical tasks which are not easily pressed into this narrow mould, although they can be classified according to the more general criteria outlined above.

In assessing the cognitive demands made by mathematics pretests, items were identified as requiring the use of concrete or formal schemata and were classified accordingly as CO or FO.

We subdivided all the ' formal operations ' items into two categories, FO1 and FO2, so that ' straightforward ' items requiring formal operations were placed in the FO1 category and items requiring more complex operations of a formal type (which could only have been done by a pupil who had reached Piaget's Stage 3B rather than 3A) were classified as FO2.

We fully accept that this use of a mixed set of criteria, some strictly derived from Piaget, others more loosely formulated, may not constitute a rigorous test of the applicability of Piaget's theory *per se* to mathematical activity, but more broadly a test of the applicability and usefulness of the criteria outlined above, which we have derived from his theory.

(ii) *Assessment of items.*

Each of us worked, together but independently, 12 pretest papers for the University of London Board's O-level examination in mathematics. Six papers were for Syllabus C and six for Syllabus D.* To each item we applied the criteria for ' concrete ' or ' formal ' thinking (for a full description of these criteria see pages 156 to 157 of this paper) and arrived independently at an assessment of the demands the item made. Each item was, therefore, coded by each of us as CO, FO1 or FO2. After every 120 items (two pretest papers) we compared judgments, discussed individual cases, and arrived at ' agreed assessments ' for items about which we had differed. On completion of all 720 items, the pretest papers were finally returned to the Subject Officer of the Board who then provided us with the item statistics. We, therefore, have our judgments of the demands made by the items and the corresponding statistics, notably the difficulty indices, but we have not ' fed back ' to ourselves information derived from any correlation between the two relating to specific items of the pretest. This is to avoid the risk that our judgments might be influenced by the actual performance of the candidates on these items rather than by the criteria we set out to use.

(iii) *Analysis of Results.*

Since the criteria for subdivision of the formal operations category into FO1 and FO2 were less specific than those we used for discriminating between concrete operations (CO) and formal operations (FO) items, it was decided to calculate all results both with and without this subdivision.

Items for the two types of syllabus were analysed separately as there was evidence from the calculation of a χ^2 statistic that the two populations were not homogeneous. By inspection it appeared that the agreement between us, although less than complete, was sufficient to warrant proceeding with an analysis based upon the combined judgments. We calculated point multiserial (Das Gupta, 1960) and point biserial correlation coefficients (Guilford, 1965) to test whether there was a significant correlation between the difficulty indices of the items and our categorisations of them according to the requirements for concrete or formal operations.

RESULTS

(i) *Agreement of judges.*

Table 1 shows the distribution of the Syllabus C items when classified by us separately. For example, there were 87 items which we each independently classified as FO1. On the other hand there were 12 items which one of us (AJM) rated as FO2, but which the other (MLB) classified as CO. The table also shows the distribution of the same (Syllabus C) items when only two categories, concrete and formal, were used. Similarly, the results for the Syllabus D items are shown. In all four distributions a coefficient of agreement, Cohen's K (Cohen, 1960) was significant beyond the ·001 level.

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* The pretest papers were Nos 441 (1971) and 550 to 554 (1972) for Syllabus C and Nos. 451 (1971) and 560 to 564 (1972) for Syllabus D. Of the two syllabuses, Syllabus C may be regarded as having a somewhat more ' modern ' approach mathematically.

TABLE 1

AGREEMENT OF JUDGES IN ASSESSING PRETEST ITEMS FOR CONCRETE OR FORMAL DEMANDS

		1st judge (MLB)			
Syllabus C items		CO	FO1	FO2	All
2nd judge (AJM)	CO	45	27	0	72
	FO1	37	87	17	141
	FO2	12	66	69	147
	All	94	180	86	360
Syllabus D items		1st judge (MLB)			
2nd judge (AJM)	CO	30	19	3	52
	FO1	23	73	35	131
	FO2	2	46	129	177
	All	55	138	167	360

Syllabus C.

(*a*) Formal operations category subdivided: $K = 0{\cdot}325$, $K/\sigma_K = 8{\cdot}49$, $P < {\cdot}001$

(*b*) Two categories (concrete/formal) only: $K = 0{\cdot}408$, $K/\sigma_K = 5{\cdot}76$, $P < {\cdot}001$

Syllabus D:

(*a*) Formal operations category subdivided: $K = 0{\cdot}418$, $K/\sigma_K = 9{\cdot}93$, $P < {\cdot}001$

(*b*) Two categories (concrete/formal) only: $K = 0{\cdot}485$, $K/\sigma_K = 5{\cdot}36$, $P < {\cdot}001$

(ii) *Distribution of items in two syllabuses.*

In both the Syllabus C and the Syllabus D pretest papers the majority of the items were agreed to be in the 'formal operations' category. Table 2 shows how the items were distributed. The difference between the Syllabus C and Syllabus D papers in the proportions of items in the agreed categories was not expected. It appears that the more 'modern' syllabus (C) had significantly fewer questions in the formal operations category than the more traditional syllabus (D).

TABLE 2

NUMBER OF ITEMS IN EACH CATEGORY OF AGREED CLASSIFICATIONS FOR SYLLABUSES C AND D.

Category	CO	FO1	FO2	All
Syllabus C	74	167	119	360
Syllabus D	48	133	179	360

(iii) *Correlation between agreed classifications and difficulty index.*

Table 3 shows the variation of the mean difficulty with category of item for Syllabus C and Syllabus D, (*a*) where the formal operations category is subdivided into FO1 and FO2, and (*b*) where it is not. The difficulty index, **x**, is the inverse normal deviate of the proportion of correct answers to an item, added to 13 to give a mean of 13 over the total population. As the table shows, there is a significant, steady rise in mean difficulty for both Syllabus C and D items over the categories CO, FO1 and FO2.

TABLE 3

Correlation Between Agreed Classifications and Difficulty Indices of Items.

·	CO	FO1	FO2	FO (FO1+ FO2)	All
Syllabus C					
No. of items	74	167	119	286	360
Mean difficulty index ..	11·73	13·45	15·16	14·16	13·66
SD of difficulty indices..	2·22	2·12	1·90	2·19	2·41
Syllabus D					
No. of items	48	133	179	312	360
Mean difficulty index ..	12·10	13·38	15·21	14·43	14·12
SD of difficulty indices..	2·76	2·14	1·59	2·05	2·30

(*a*) Formal operations category subdivided .
Point multiserial correlation coefficient, r_{pms} . Syllabus A, 0·514; Syllabus B, 0·500
(*b*) Two categories (concrete/formal only) :
Point biserial correlation coefficient, r_{pbs} : Syllabus A, 0·408; Syllabus B, 0·344
All P $< \cdot 001$

Note—The difficulty index is the inverse normal deviate of the proportion of correct answers to an item, added to 13, to give a mean of 13 over the total population.

DISCUSSION

These results show that we are able to assess pretest items in such a way that our resulting classification of them is significantly correlated with their indices of difficulty. Clearly there is some overlap, in that there were some items classified as FO with difficulty indices lower than those of some items classified as CO. This is not unexpected and can be accounted for in several ways. Apart from possible inaccuracy of our judgments of concrete and formal, the effect of training in rote-learned strategies for the solution of certain standard FO items, and the effects of factors other than the demands for concrete or formal thinking which, nevertheless, contribute to item difficulty, ought to be considered.

Our interpretation of our results is that

(i) we have been able to identify the items which require formal thinking

(ii) the fact that, in our judgment, they demand formal thought is the principal reason why these items are found to be significantly more difficult than the items which do not.

As can be seen from the data of Table 1, there was agreement between us some 83 per cent of the time as to the placing of items in the concrete and formal categories, but this does, of course, mean disagreement 17 per cent of the time. Some of the initial disagreement was due to the fact that one of us had not spotted a simpler strategy of solution which required only concrete operations. One of the reasons for allowing discussion after every 120 items was that it would enable both of us to spot the possibility of applying such simpler strategies in subsequent cases. Examination of the whole run of 720 judgments over the six papers does show a slight decrease in the incidence of items over which serious discrepancies occurred. An alternative, and possibly more rigorously controlled, experiment would have allowed a number of independently done non-scored practice assessments of items, followed by discussion and harmonisation, and then experimental sessions assessing a sufficient number of items, followed by discussion at the end. This is being considered as a possibly better alternative procedure for future experiments.

Without doubt lack of agreement indicates some uncertainty in our application of the criteria. This may be due either to some lack of clarity in our formulation of them or to their sheer inapplicability in the case of some items. Agreement is a problem in all exercises in which people make judgments requiring the application of complex criteria, and work is in progress on the further clarification of the criteria used here. In the meantime, there are two other studies which might usefully be undertaken. One is to ask other judges, with varying degrees of briefing, to rate the same items in the way that we did, and so test further the reliability of applicability of our criteria. The other is to repeat the exercise using tests which have a more even spread of items over the concrete/formal range. The reason for choosing pretest items in the first place was that it was thought that operational O-level papers would have too few FO2 items for our purpose and that pretest papers would contain more, some of which might later be rejected by test construction committees on grounds of difficulty. As we can now see, the paucity of ' concrete ' items in the pretests makes it unlikely that operational O-level papers will contain many of them, and we would instead choose, if doing the exercise again, items set in a CSE examination.

What guarantee have we that the judgments were made using the stated criteria, and not some other criteria which we shared, either consciously or unconsciously? Such unconscious criteria could be present as a result of our experience of children's difficulties in learning mathematics, and the form of the experiment was such that we did not lack opportunity to discuss and so share such ' hidden ' criteria. Clearly, with human judgments of any kind unconscious influences are at work, and further study is needed both generally on the objective application of stated criteria and, in our case, of those items over which we disagreed and the reasons why the criteria were difficult to apply.

A further test would be afforded by a variant of an experiment suggested earlier in which judges not sharing our experience of teaching children mathematics would rate these same 720 items.

Even if we were using the criteria stated, these may not validly mark the distinction Piaget is making between ' concrete ' and ' formal.' If they do not, then this investigation does not test the applicability of Piaget's theory to mathematical activities such as solving multiple choice questions. Instead, it tests the applicability of criteria we have formulated (e.g., the use of the concepts of concrete and formal models) which may be inspired by Piaget's distinction, but may differ from it or fail to capture the whole of it.

We hope to have reflected faithfully, in a usable form, Piaget's meaning. If, however, our formations are not accurately derived, we shall be content to explore them as they stand, particularly the distinction between concrete and formal models, for here we believe there to be something which in itself has psychological validity and which is capable of empirical exploration in the field of mathematics learning, as recent studies of the simulation of children's thought processes (see Klahr and Wallace, 1970) and experiments on mental imagery (see Paivio, 1971) as well as our own informal observations suggest.

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THE EFFECT OF VERBAL TEACHING STYLE ON THE ATTAINMENT OF EDUCATIONAL OBJECTIVES IN PHYSICS

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SUMMARY. Analyses of variance and covariance were used in this longitudinal study of the effects, cognitive and affective, of different teaching styles (as identified by Flanders' interaction analysis technique) on the learning of physics by 14–16-year-old pupils following an O-grade course for the Scottish Certificate of Education. The 'open-ended' style achieved the more complex cognitive educational objectives more successfully than did either the 'intermediate' or 'expository' styles. On the whole, the 'open-ended' procedure was the most successful in developing favourable attitudes towards physics.

INTRODUCTION

THREE factors have characterised the re-orientation that has taken place in the teaching of physics in Scottish secondary schools over the past 10 years or so.

The first was the radical change in syllabus content brought about by the introduction of the Scottish Alternative syllabus about 1964—a change intended to take more account than hitherto of developments in physics since 1890. The second factor was the equally radical change in the manner of teaching the new material. The old method had been based firmly on teacher demonstrations of routine experiments, the main purpose of which was to confirm the formal relations between physical qualities. These experiments were frequently described by the teacher in the form of dictated notes which delineated in fine detail the precautions to be observed in order to obtain results corresponding as closely as possible to the anticipated values. It was hoped that the advent of the new syllabus would see this style replaced by a new teaching and learning environment in which more emphasis would be on pupil experimentation. Pupils were to discover for themselves the operational concepts of physics in learning situations structured for them in an open-ended way. The pupils would then report their own findings in their own words. The third factor was the more recent introduction into Scottish educational thinking of the concept of educational objectives such as those classified by Bloom *et al.* (1956) into three domains, cognitive, affective and psychomotor. The cognitive domain deals with abilities which are generally intellectual; the affective with interests, values and appreciation; and the psychomotor with motor skills and manual or manipulative dexterity.

In recent years the science syllabuses of the Scottish Certificate of Education Examination Board (1972) have contained references to a taxonomy of educational objectives specified in terms of each subject. The hierarchy of cognitive objectives pertaining to the physics syllabus is based on that of Bloom and is described below.

The present investigation is concerned with testing the hypothesis that the new style of teaching physics is more effective than the old in terms of pupils' attainment of desirable educational objectives, both cognitive and affective. Heaney (1971) claims that in biology, heuristic teaching is more effective in promoting cognitive attainment than more expository methods. Is a parallel effect observable in physics?

VARIABLES, SUBJECTS, INSTRUMENTS

(1) *Variables involved.*

The attainment by pupils of particular educational objectives should depend on a number of identifiable variables in the teaching situation. Those selected for this investigation are (i) teaching mode, including verbal style; (ii) pupils' IQ; (iii) pupils' motivation, related to socio-economic class.

As indicated below, in selecting the area in which the investigation was carried out, we aimed to control variables (ii) and (iii). Much research has shown these factors to be important.

(2) *Criteria for selecting schools, teachers and pupils.*

In selecting schools, teachers and pupils we took the following considerations into account: (i) The schools should be homogeneous in respect of certain criteria as stated below. (ii) In addition, physics teachers in these schools should represent as wide a spread as possible on a continuum or spectrum of teaching styles, as described below. (iii) The pupils should be in their third and fourth years (ages 14-16).

(i) *Schools*: We considered it important that the investigations be carried out in schools which so far as possible satisfied the following criteria:

(1) They should be similar to each other, in relation to such variables as staffing, provision of equipment, laboratory staff, etc.

(2) They should not serve a totally rural or totally urban area since environmental factors in pupils' lives outside school might influence attainment of educational objectives related to attitudes. In an industrial area, attitudes of pupils towards physics might be more favourable as a result of parental involvement in industry.

(3) All schools should have a record of examination success in physics near the national average.

We employed these criteria in order that findings should be as widely generalisable as possible and not restricted to special circumstances.

(ii) *Teachers*: We attempted to classify physics teachers on a spectrum of verbal styles with one end of the spectrum occupied by teachers authoritarian and dogmatic in style, and the other by teachers whose style was heuristic and open-ended.

In spite of the syllabus changes that have taken place, there are still many teachers who dominate the classroom environment, perform most of the experiments themselves, and generally teach physics as a series of dogmatic statements. Where pupils are permitted to do experiments, expository teachers tend to explain beforehand exactly what has to be done, what experimental measurements to take and even what results to expect. They tend to interact with the class in an expository way, rarely ask questions and only seldom involve pupils' participation. Such teachers constitute one end of our spectrum.

At the other end of the spectrum, we sought to identify teachers who are skilled exponents of the open-ended style, who provide learning situations for their pupils based on experiments and who expect pupils to draw their own conclusions based on their own interpretation of results. We hypothesised that by constantly asking questions and prompting pupils to make their own discoveries, such teachers would exploit learning situations in a different way from their more expository colleagues.

Several recent studies of classroom interaction have been concerned with various aspects of science teacher behaviour. One of the more recent is that of Wragg (1973). Other studies of science teaching style include those of Matthews (1969), Pancratz (1967), Sharp (1966), Snider (1966), and Tisher (1968).

In the present investigation we decided for practical reasons to limit the study to the verbal interaction occurring between teacher and pupils. This limitation, however, should not be taken to imply a belief that the teachers' verbal style is necessarily characteristic of his total behaviour in the classroom. Flanders' method of interaction analysis in the classroom (1970) was used as the observational technique for classifying teachers' verbal style. In this 10-category system, the first four represent teacher talk characteristic of the open-ended teacher; categories 5–7, teacher talk characteristic of the dogmatic, expository teacher; categories 8 and 9, pupil talk; while category 10 represents periods of silence or confusion or other communication events not covered by the other categories.

Only the interaction episodes between the teacher and the class as a whole were recorded. Discussions between the teacher and small groups of pupils while the pupils were doing experimental work were excluded; not because we considered them unimportant—indeed, those might well be the most important verbal interactions of all—but simply because of the impossibility of recording them without intruding on the situation to such an extent as to distort what was taking place. In any case, the general noise level and the habit of pupils and teacher of conversing quietly in group discussion during pupil experimental work precluded the recording of these interaction episodes.

Teachers' styles on the open-ended-expository dimension were estimated by an index based on the Indirect/Direct ratio described by Flanders, i.e., categories 1–4/categories 5–7. This index I/D was obtained for each teacher on the basis of six visits to all teachers in the study, each visit occupying two periods of about 40 minutes each. In general, more than 5,000 tallies were recorded for the six visits. The mean I/D index for each teacher is shown in Table 1 together with its standard error.

One of us coded all observations in writing in the classroom; no tape-recording of lessons was attempted. During the observation period, different teachers dealt with different topics; and since the amount of pupil involvement is a function of the topic as well as of the teachers' style, we were unable to consider the extent to which verbal style was related to willingness to give pupils experimental work to carry out for themselves.

In order to check the extent to which teachers described as extreme in the study merited that description in the country as a whole, we obtained I/D scores for two reference teachers who, in the opinion of experts, represent respectively the most open-ended and the most expository styles of all physics teachers in the country. These are also shown in Table 1.

TABLE 1

VERBAL TEACHING STYLE. AVERAGE INDIRECT/DIRECT (I/D) RATIO INDEX FOR TEACHERS

Teacher Style	Teacher Code	No. of Visits	Mean I/D ratio	SE
Open-ended	*X	4	0·819	0·128
Open-ended	H	6	0·676	0·145
Open-ended	K	6	0·638	0·195
Intermediate	G	6	0·362	0·125
Intermediate	J	6	0·345	0·0915
Expository	L	6	0·195	0·0388
Expository	F	6	0·211	0·0918
Expository	*Y	4	0·275	0·0891

* Denotes reference teachers

In this way we selected six teachers in our four different schools. On the basis of observation of each on two occasions, two of the teachers were regarded as being very open-ended in teaching style, two as extremely expository, with the other two somewhere in between. All six had at least five years' teaching experience and were generally regarded as competent. No special attention was paid to age or other factors which might influence a teachers' verbal style. We were concerned with estimating the teacher's style, not with the reasons for it.

Over the past two years each teacher has been observed on four occasions while teaching a particular group of pupils in his own school; twice in third year and twice in fourth. As stated above, the purpose of the present study is to relate pupils' educational attainment to the differing styles of their teachers. During the two-year period concerned, these pupils were taught only by the teacher in the study although some would have been taught previously in first and second years by that teacher and some by others. It is further possible that some pupils have been influenced in their attitudes towards physics by what has happened to them in other departments of the school or by people and events outside it.

(iii) *Pupils*: The major problem was that of selecting schools which measured up to the criteria above and which at the same time had on their staff teachers of physics who among them represented the spectrum of styles central to the investigation. The identification of these schools automatically identified also the pupils concerned in the investigation: the pupils in third and fourth years (six classes) in the schools so identified. We rejected the first and second years because in many schools the pupils at this level do not study physics as a separate subject but as part of integrated or general science. We rejected also the fifth and sixth years on the ground that teachers often feel constrained to 'lecture' to the higher classes because of the greater maturity of the pupils, with the result that our spectrum of styles would have been much narrower.

(3) *The Instruments used.*

These were tests of attainment of objectives in (i) the cognitive domain, (ii) the affective domain.

(i) *Tests of attainment in the cognitive domain.* Near the end of their third year, each group of pupils took the same attainment test without previous warning from their teacher. The test was designed to cover topics dealt with in class during third year. It consisted of 40 five-response items (one correct response and four 'distractors') and lasted one hour. All items had been revised after pretesting on a similar group of pupils. One mark was awarded for each item correct. A wrong answer incurred no penalty and no correction for guessing was applied.*

The Scottish Certificate of Education O-grade physics syllabus being followed by all teachers and pupils in the experiment specified the following hierarchy of cognitive objectives.

Category A—Knowledge: Recall of useful information.

Category B—Comprehension: Ability to apply a principle to a situation which it is reasonable to expect pupils to have encountered and in which the principle used should be obvious.

Category C—Application: Ability to apply a principle to a situation which most pupils would not have encountered in class and in which the pupil must first select the appropriate principle.

Category D—Highest Abilities: Blooms' analysis, synthesis, and evaluation, including

(i) the ability to apply principles to problem situations involving two or more stages for their solution ,
(ii) the design of an appropriate experiment and/or the selection of apparatus of suitable range, type and sensitivity ,
(iii) the critical appraisal of measurements and the interpretation of data;
(iv) the ability to communicate and provide an explanation or criticism ,
(v) the ability to think creatively to some degree, e.g., in proposing a hypothesis ;
(vi) the ability to solve problems which involve longer calculations requiring a sequence of steps ;
(vii) the ability to use data obtained from an experiment, to select an appropriate method of displaying the results and to draw conclusions.

Before this 40-item test was administered, one of the objective categories A, B, C or D, had been ascribed to each item on the basis of a majority decision from the subjective judgment of each teacher in the study, those of two independent experts, and that of the experimenter. On this basis, 31 items were judged to be testing category A or B objectives and the remaining 9 category C or D objectives.

(ii) *Test of attainment in the affective domain.* There is no specified list of attitudinal objectives for the Scottish Certificate of Education O-grade course in physics although Curriculum Paper 7 (SED, 1969) lays down guide-lines for the second cycle (third and fourth years) of science courses for non-certificate pupils.

It is not certain that the development of attitudes in the realm of physics is directly associated with the teacher's style as such. Objective 3, for example (see below), might be encouraged by a teacher who, whatever his teaching style, is a radio club enthusiast.

A pilot attitude questionnaire using Likert's method of summated ratings (1932) was devised. It consisted of 50 statements based on those constructed and used by Brown (1970)* at Stirling University to study attitudes of pupils in the first and second years towards the Scottish integrated science course. In this pilot questionnaire, we invited pupils to express agreement or disagreement with each statement on a five-point scale. In our view these statements are linked to the following list of affective objectives which clearly derive from the Scottish Education Department (1969) guide-lines and which we hypothesised might be influenced by teaching style.

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* Details of the test are available on written request to the authors.

(1) Awareness of relationship of physics to other disciplines of knowledge.
(2) Awareness of the importance of physics in the working, leisure and social aspects of the community and society in general.
(3) An interest and a willingness to participate in physics-based leisure pursuits.
(4) An interest in gathering information about physics through all the media of communication.
(5) An attitude of objectivity to all decisions and assessments required of the individual.
(6) An enthusiasm for physics as an attractive and satisfying intellectual discipline.

This pilot version was pre-tested with third year pupils outside the study and the items scored using the method indicated by Edwards (1957). Each of the 50 statements was attributed to one or more of the six attitudes above and scores obtained for each pupil on each attitude. Item analyses were carried out within each attitude by calculating values of t based on the difference of mean scores between (i) pupils whose scores in that attitude were in the top 25 per cent of the pre-tested sample and (ii) pupils whose scores on the same items were in the bottom 25 per cent. Product-moment correlation coefficients, calculated between scores for each attitude, suggested the combination of attitudes 1 and 2, and of attitudes 3, 4 and 6. Further item analyses, conducted for pupil scores in the new combined attitudes, led to the preparation of the final version of the questionnaire. This consisted of 38 statements or items (see Appendix) ascribed as follows:

Attitude I. Awareness of the significance of physics in everyday life—11 items.
Attitude II. An attitude of objectivity learned from physics—10 items.
Attitude III. An interest in and enthusiasm for physics—17 items.

RESULTS

(1) *Homogeneity of background variables.*

Although it was impossible to take account of all possible relevant variables, we considered it essential to control for such important factors as IQ and social status as measured in terms of father's occupation on the Hall-Jones Scale.

Table 2 shows the observed means for IQ and Hall-Jones Index (the independent variables) at the three teaching styles; and also the corresponding means for categories (A+B) and (C+D) of the attainment test and for the whole attainment test (the dependent variables).

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* The authors are indebted to Mrs. Sally Brown for permitting them to make use of test material in the present investigation.

TABLE 2

ATTAINMENT TEST INITIAL MEANS—INDEPENDENT AND DEPENDENT VARIABLES FOR DIFFERENT TEACHING STYLES

		Independent Variables		Dependent Variables		
Teacher Style	N	IQ	HJ Index	Cat. A+B	Cat. C+D	Total
Open-ended	39	115·28	4·05	20·49	5·72	26·21
Intermediate	39	112·36	4·33	18·26	4·28	22·54
Expository	29	110·38	4·34	18·38	4·24	22·62
All	107	112·89	4·23	19·11	4·79	23·90

Inspection of the attainment means suggests that the open-ended style has proved superior in each category and overall, and that there is little to choose between the results obtained with the other two styles. However, these effects may be related to initial difference in the independent variable means also apparent in Table 2. It was felt that to be on the safe side it would be well to adjust attainment for initial IQ and social status differences.

(2) *Adjustment of attainment for initial differences in independent variables.*

Analysis of covariance was used for this purpose. After taking account of inter-style differences in IQ and social status, the adjusted analysis for the three attainment measures gave the results shown in Table 3.

TABLE 3

ATTAINMENT TEST. ATTAINMENT MEANS AFTER ADJUSTMENT FOR INITIAL IQ AND SOCIAL STATUS DIFFERENCES.

	Categories		
Teacher Style	A+B	C+D	Total†
Open-ended	19·97	5·51	25·46
Intermediate	18·39	4·33	22·73
Expository	18·88	4·45	23·36
F	1·93	5·49*	4·53*

(df 2,102)
* $P < \cdot 05$.

† Because each of the three columns of means has been independently adjusted, entries in the 'Total' column are not the exact sums of corresponding entries in the other two columns.

The F's at the foot of Table 3 should be looked at first. They indicate that after adjustment for differences in initial IQ and social status there still remain significant differences in the attainment represented by categories C and D (Application and Higher Abilities). This is also the case for attainment overall, but not for categories A and B (Knowledge and Comprehension).

Subsequent analysis of the differences among individual adjusted means within columns of Table 3 using the appropriate standard error (Goulden, 1952) showed the following results:

(*a*) As expected in the light of the one non-significant F in Table 3, there were no significant differences among the three adjusted means in the case of objective categories A and B.

(*b*) The pupils taught in an open-ended style obtained a higher mean score (significant beyond 5 per cent) than did pupils taught in the other styles in the items adjudged to be testing the higher abilities (categories C and D), and also on the test as a whole.

(*c*) There were no significant differences in attainment on either part of the test or on the test as a whole between pupils taught in the intermediate and expository modes.

We intend to administer further tests of attainment of cognitive educational objectives at a later stage.

(3) *Attainment of affective objectives in physics.*

(*a*) *Attitude shifts.*

In order to look at changes in attitude to physics we administered the attitude questionnaire twice to all pupils in the study: at the beginning of third year before the pupils had been taught any physics as such, and at the beginning of fourth year after one year of physics. It is generally recognised that attitudes to school subjects are likely to vary according to the proximity of examinations, holidays and so on. Some attitudes, such as 'I like physics,' are quickly developed and as quickly disappear. Others, such as an attitude of objectivity, may take longer to establish, but are then less likely to be lost.

The questionnaire was scored on both occasions as in the pre-test. In view of the 12-months interval between the two administrations, we considered that the effect of the pre-test on the post-test would be minimal.

Before looking at the results from the two administrations of the attitude questionnaire, it is necessary to establish whether initial inter-style differences on the independent variables (IQ and Hall-Jones Index) are likely to affect the outcome. The non-significant differences among the means displayed in Table 4 suggest that in this case* it is reasonable to infer inter-style homogeneity in respect of these independent variables. This means, fortunately, that we can leave these variables out of account in interpreting the results from our questionnaire.

TABLE 4

ATTITUDE QUESTIONNAIRE MEAN PUPIL IQ AND HALL-JONES INDEX FOR DIFFERENT TEACHING STYLES.

Teacher Style	N	Mean IQ	Mean HJ Index
Open-ended	38	115·17	3·97
Intermediate	33	113·33	3·97
Expository	33	111·45	4·31
All	104	113·41	4·08
F		1·31	1·03

Analyses of variance between and within teaching styles give F's not significant at 5 per cent level (df 2,101).

* The figures in Table 4 refer to those pupils who answered the attitude questionnaire on both occasions

Table 5 shows the mean scores on the questionnaire ; $\overline{X}$ (first occasion), $\overline{Y}$ (second occasion), for different teaching styles and all three attitudes. It shows also the corresponding mean differences $(\overline{Y}-\overline{X})$ which we take to represent approximately the attitude shift produced by one year of physics—approximately, since other factors not controlled for in the experiment (e.g., maturation, effects from other subjects) may also have contributed to the shift. Table 5 shows also one further column which will be discussed later.

TABLE 5

MEANS OF PUPIL SCORES IN ATTITUDE QUESTIONNAIRE.
(X is score on first occasion and Y on second occasion one year later.)

Teacher Style	No. of Pupils	$\overline{X}$	$\overline{Y}$	$(\overline{Y}-\overline{X})$	$\overline{Y}'$
Attitude I : Awareness of significance of physics in everyday life.					
Open-ended	38	31·94	30·18	—1·76*	29·23
Intermediate	33	29·82	30·45	+0·63	30·81 }*
Expository	33	29·21	27·33	—1·88*	28·06 }
Attitude II : Objectivity learned from physics					
Open-ended	38	27·63	30·03	+2·40†	30·04
Intermediate	33	26·82	28·73	+1·91†	29·07
Expository	33	28·54	30·64	+2·10*	30·28
Attitude III : Interest in and enthusiasm for physics.					
Open-ended	38	51·55	47·29	—4·26†	43·83 }
Intermediate	33	45·73	42·79	—2·94*	43·22 } }*
Expository	33	41·03	34·15	—6·88‡	37·73 }* }

* P<·05 †P<·01 ‡P<·001 (on one-tailed test)

Although an equal interval property cannot necessarily be assumed for scores obtained on Likert scales (Siegel, 1956) the results were analysed using parametric techniques regarded as sufficiently robust for the purpose.

Table 5 summarises the results of statistical analyses (t test for correlated data) carried out on the pupil scores in the attitude questionnaire. The mean shifts of attitude and their significance are shown for each attitude and for each style within attitude.

Attitude I. The table shows that, except for the pupils taught in the intermediate style, a *reduction* in mean scores occurred from the first to the second occasion for Attitude I.

Attitude II. For Attitude II, the table shows a significant *increase* from the first to the second occasion for all teaching styles.

Attitude III. Finally, the table shows that for Attitude III there was a significant *reduction* in mean scores from the first to the second occasion for all three styles.

In general, Table 5 reveals little interaction between style and occasion within attitudes : that is, with one exception the shift within a particular attitude is in the same direction for each style. It will be noted that the largest shifts occur for Attitude III, and within that attitude for the expository style. However, not too much store should be set on the relative differences in magnitude of these shifts from one attitude to another. Since different questions were asked in respect of each attitude, across-attitude comparisons may not be legitimate.

All pupils in the study still at school at the end of fourth year will be asked to complete the questionnaire for a third and last time.

(*b*) *Effect of style on attitude.*

We turn now to a rather different question : to what extent is attitude (not attitude shift) affected by teaching style ? It might seem at first sight that this question is answered by the column of $\overline{Y}$ means within each attitude (Table 5), since these represent the mean ' scores ' on the attitude questionnaire after one year of physics.

However, this argument takes no account of the attitude differences displayed by the column of $\overline{X}$ means, which represent the initial state of affairs *before* the formal teaching of physics was begun with these pupils. Arguing that initial status on attitude can owe nothing to subsequent exposure to physics, while at the same time final status may owe something to initial status, we have, therefore, covarianced out the effect of this initial status. The result is the column of adjusted means $(\overline{Y})'$ at the extreme right of Table 5. The differences between those adjusted means that are bracketed are significant at the levels shown : no other differences are significant.

DISCUSSION

(1) *Verbal teaching style.*

As shown in Table 1, the verbal teaching style of Scottish physics teachers varies across a broad spectrum from open-ended to expository. It is interesting to compare these results with the findings of Wragg (1973) for a group of student teachers in England. Using the same interaction analysis technique Wragg reports a mean I/D ratio of 0·27 on a Millage Matrix from 37 visits compared with 0·37 from 44 visits in our study.

(2) *Attainment of cognitive objectives in physics.*

As reported at 2 (*b*) above, the evidence suggests that pupils taught in an ' open-ended ' style achieve the more complex cognitive educational objectives more readily than do those taught in either of the other two styles. In interpreting the observed mean differences of rather more than one point of score in favour of the ' open-ended ' style, it must be remembered that the test of the relevant objectives (C and D) consisted of 9 items only. We are inclined to regard this as one of our more important findings. Later results in a continuation of the present study will provide further evidence on this point.

(3) *Attainment of affective objectives in physics.*

The results suggest that for all styles the pupils were in general less aware of the social and general implications of physics (Attitude I) after one year of studying the subject than at the beginning. This is perhaps to be expected where the syllabus lays little stress on the social implications of physics and does not emphasise links with other scientific disciplines.

However, all groups of pupils, regardless of teaching style, did seem to have an attitude of greater objectivity in making scientific judgments (Attitude II) after studying physics for one year. It could be argued though, as already suggested, that this enhanced objectivity might be attributable, in part at least, to influences other than events in the physics class; and the possible effect of maturation should not be ignored. There are indications also that all groups of pupils in the study had lost interest in and enthusiasm for physics (Attitude III) after one year of a fairly academic course in physics. This could confirm the findings of Mackay (1971) and Gardner (1973). Later experimental investigation planned in the study should provide more evidence of the effect of a modern physics syllabus on pupils' attitudes to the subject.

As to the effect on attitude of teaching style, our evidence is mixed. As Table 5 shows, differences in style find no reflection in differences in attitude of objectivity (Attitude II). There are indications that for awareness of significance of physics in everyday life (Attitude I), the expository style comes off worst. A similar conclusion, though more clear-cut, holds for interest in and enthusiasm for physics (Attitude III). We shall look for further evidence on these points when the results of the next administration of the attitude questionnaire comes to hand.

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APPENDIX

QUESTIONNAIRE STATEMENTS

1. Physicists should criticise each other's work.
2. I would enjoy doing scientific work when I leave school.
3. Mathematics is a great help to physics.
4. I am not interested in physics.
5. Physics helps you to develop hobbies outside school.
6. If the teacher and I do the same experiment but get different results, the teacher's result is the right one.
7. Physics is very useful in several of my other school subjects.
8. The TV programme *Tomorrow's World* is boring.
9. Only people who are going to do scientific work should have to learn physics.
10. I enjoy physics.
11. Biologists studying plants and animals do not need to know anything about electricity.
12. If a famous physicist and an unknown physicist disagree we accept the opinion of the famous physicist.
13. Space research is no use to ordinary people.
14. Science clubs don't interest me.
15. Physics teachers know the scientific truths.
16. I would not like to be a physicist.
17. There should be more programmes on TV about physics.
18. A good scientific theory does not supply the final answer to scientific questions.
19. Physics does not help someone to learn geography.
20. Physicists are boring people.
21. Physics should be left to those who are scientists or are going to be scientists.
22. Experiments which give answers that disagree with what the teacher expects are useful.
23. I wish we had more physics in school.
24. New discoveries in physics are important to everyone.
25. Physics is boring for me.
26. If a good physicist says that a theory is true all other physicists will believe him.
27. I like tinkering with things like old clocks and radios at home in my spare time.
28. I make use of physics every day.
29. I hate physics.
30. Theories in physics supply the true answer to physics questions.
31. The school library should have a lot more books about physics.
32. Physicists are very interesting people.
33. Physics teaches us not to believe everything we are told.
34. I like listening to radio programmes which are concerned with physics.
35. Chemistry is of little help to physics.
36. Physics is one of my favourite subjects.
37. A useful theory in physics may not be entirely correct.
38. Pupils who enter for scientific competitions like *Science Fair* are wasting their time.

THE TEACHING OF SERIAL TASKS USING CHAINING STRATEGIES

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SUMMARY. The experiment was concerned with teaching two types of chain or serial task. The chain types were paper-folding, regarded as a motor assembly task, and numerical procedures.

The aim of the experiment was to investigate the effect of chain length (short, medium and long) and teaching strategy (backward chaining, forward chaining and whole method) on the acquisition and retention of the two types of chain. 176 women students were randomly assigned to nine groups (3 × 3) defined by chain length and teaching strategy. Within each group a motor and a number chain were taught by means of self-instructional programmes and followed by practice to a criterion of one promptless trial. One week later the tasks were relearned to the same criterion.

No advantage was found for backward chaining in the case of the motor chains and the short and medium number chains. However, for the long number chain there was some indication that backward chaining was superior to forward chaining. Both methods were in general inferior to the whole method.

INTRODUCTION

ONE of the more systematic approaches to the design of learning materials is that of mathetics. This has been developed by Gilbert (1962a, 1962b) from the theoretical basis of operant conditioning. One of the interesting features of his system is the recommendation that serial tasks or 'chains' should be brought to mastery by a cumulative retrogressive method. This procedure, known as backward chaining, may be illustrated for a four stage chain $A \longrightarrow B \longrightarrow C \longrightarrow D$ as follows:

First do D
Then do C and follow with D
Then do B and follow with C and D
Finally do A and complete B, C and D.

Backward chaining has been described by Skinner (1938) and has become the typical procedure for establishing animal chains (Keehn, 1959). It has been recommended as a technique for human learning (Gilbert, 1962a; Mechner, 1967) on the grounds that it allows the learner to receive terminal reinforcement many times while learning the steps of the chain and helps the perception of how each part is related to the final product (Harless, 1967). The procedure is mirrored by a cumulative progressive method called forward-chaining in which assembly of the chain occurs from the beginning rather than the end, thus:

First do A
Then do A together with B
Then do A together with B and C
Finally, do A and complete B, C and D.

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* This research was carried out when the author was at Doncaster College of Education.

Several experiments have followed from Gilbert's advocacy of backward chaining but have failed to provide support for the superiority of the technique. Two experiments (Slack, 1964; Hartley and Woods, 1968) investigating the learning of poetry found no difference between backward chaining and forward chaining. The same finding has also been reported by Scott (1968) using square root extraction as the learning task. More recently, Balson (1971), also using an arithmetical procedure, found backward chaining inferior on learning time to forward non-cumulative methods. Cox and Boren (1965) using a military procedural task found that a backward chaining method was as effective as a forward chaining and a whole method of learning. However, Duncan (1969, 1971) found backward chaining inferior to forward chaining and a 'middle outwards' method (a method starting at the middle of the chain and alternately adding items to the left and the right). The inferiority of backward chaining compared to forward chaining was also indicated in experiments by Johnson and Senter (1965) using meaningless serial lists of numbers and consonants.

It should be noted, however, that not all experimenters distinguish backward chaining from a similar but not identical procedure which Mechner (1967) calls 'backward fading.' Under backward fading the chain given to the learner is 'faded out' by presenting successively decreasing portions of it which he is required to complete, i.e.:

Given A, B and C do D
Then given A and B do C and D
Then given A do B, C and D
Finally do A and complete B, C and D

Under both methods the learner completes the stages in the same sequence. However, under backward fading, opportunity is provided for learning the presented portions of the chain, and these may also provide prompts for the subsequent completion of the chain. Of the experiments mentioned above, only two (Johnson and Senter's experiment II, 1965, and Hartley and Woods, 1968) provide an unequivocal comparison of backward chaining and its mirror image, forward chaining. The others have been concerned with fading rather than chaining, or with variants of fading and chaining techniques.

With the possible exception of the Cox and Boren (1965) experiment, where it is not clear from the account whether the learners actually carried out a sequence of operations as opposed to learning the descriptive procedure, the chains investigated have been verbal ones. As the technique of backward chaining derives from animal experiments in *motor* learning, it is surprising that the method does not seem to have been investigated currently for learning human motor tasks. The nearest approach to this seems to be provided by two early experiments (Pechstein, 1917, Hanawalt, 1934) comparing different methods of human maze learning. Although both experimenters found a repetitive part (forward chaining) method superior to a reversed repetitive (backward chaining) method it is not known whether the difference reached statistical significance.

It may be that the relative advantages of different chaining methods may be a function of various characteristics such as chain type and chain length. For this and the other reasons stated above, it may be premature on the basis of these few experiments to rule out the possibility that backward chaining is an efficient learning technique for humans.

The present experiment, part of a larger study, was designed to make an unequivocal comparison of forward and backward chaining for the acquisition and retention of both verbal and motor tasks of different chain length. Two task areas were selected: one, as in Scott's (1968) study used numerical procedures, the other consisted of ' origami ' (paper-folding) tasks. The former were solutions to problems in co-ordinate geometry learned as a rote series of arithmetic operations. They provided tasks which may be regarded as intermediate in meaning between the poetry of Hartley and Woods (1968) and the number and consonant lists of Johnson and Senter (1965). Paper-folding was also chosen since it is an example of a motor assembly task. In addition, it is possible to provide the learner with the various stages of partial completion of a task which a chaining strategy requires; this is done easily and at very little cost. Both task areas were presented by specially constructed programmed learning booklets and self-instructional flow charts.

Each task area consisted of three chains of different length (short, medium, long). In the case of the numerical procedures all three chains involved the four basic arithmetic operations but differed in the number of such operations. The three-paper-folding procedures differed in the number of folding and other operations involved, and in order of increasing chain length resulted in the production of a model of a fish, a bird and a cardinal's hat. The numerical and motor (paper-folding) chains were divided into a number of component stages or ' spans,' each containing where possible the same number of arithmetic operations or folds. Each short, medium and long chain contained three, six and nine spans respectively. Attempts were made to reduce the possibility of variation in the difficulty of the different spans within a chain by a process of cumulative revision adopted in the try-out stage of the draft materials.

Each chain was taught by one of three chaining strategies; repetitive part or forward chaining (FC), backward chaining (BC), and a whole method (WM). Under the whole method, subjects did the first span, followed it immediately with the second, then with the third and so on until the whole chain had been executed. This method was included since it was felt that it approximates closely to the way in which chains are often learned in everyday life, e.g., in learning a poem by the whole method one reads stanza one then stanza two and so on until one has read the whole poem. In designing the instructional materials for BC an attempt was made to keep the procedure as close as possible to a chaining rather than a fading strategy. Thus, for the numerical procedures subjects were presented only with the result at each span of the calculation and not with the spans preceding it. In this way the possibility of learning the earlier parts of the chain whilst completing the later ones was eliminated.

EXPERIMENT I (ACQUISITION)

Method.

Subjects and design. The subjects were 176 women students in their first year at a college of education. Each subject was instructed in a motor chain and then a number chain by one of three strategies (WM, FC, BC). In order to equalise approximately the total learning time, the chains were practised in one of three orders: long motor and short number; medium motor and medium number; and short motor and long number. Thus, nine groups (3×3) were defined to which subjects were randomly assigned.

Independent variables manipulated in the experiment were chain length and chaining strategy. Dependent variables included total time, total prompts and total spans practised to reach criterion.

Procedure. For the motor chains each subject was provided with paper sheets for folding, an instructional booklet of diagrams showing the stages of folding and, depending on the chaining strategy to be practised, one of three instructional flow charts. In the case of those practising under BC, subjects were provided with paper folded to the various span stages, i.e., to begin with subjects were presented with paper folded to the penultimate span and were required to complete the last span. The material was so designed that a record could be made of the time of starting and completing the task and, for BC and FC, the number of prompts (obtained by referring back in the booklet) needed. After the model had been completed it was practised in normal serial order, to a criterion of one perfect trial (i.e., no prompts needed from the booklet). The time of starting and completing the model to criterion, and the number of prompts needed were recorded on a further flow chart.

After completing the model to criterion subjects began the number chain. For this they were provided with an instructional booklet in which they inserted the result of each span of the calculation. On turning the pages of the booklet, the correct answers were revealed which subjects could compare with their own. The time of starting and completing the procedure was recorded and in addition the FC and BC booklets allowed the recording of the number of prompts needed (references back). Subjects then practised the number procedure in normal serial order using a special criterion booklet, until it could be done without prompting. In order to ensure that it was the procedure which was learned rather than a series of numbers, different numerical values were used for each criterion trial. Again the time of starting and completion and the number of prompts required were recorded.

Results.

Some loss of data arose due to failure to complete the tasks correctly. In the case of the motor chains full data for the dependent variables reported here were obtained for 168 subjects. For the other chains the numbers were 161 and 165. Scores on the dependent variables were obtained as follows:

(1) total time to reach criterion=time for instruction under the particular strategy and time to repeat the chain to criterion

(2) total number of prompts to reach criterion=number of spans prompted during instruction and number of spans prompted during criterion

(3) total spans practised to reach criterion=number of spans practised during instruction and number of spans practised during criterion.

A two-way analysis of variance (fixed effects model) was carried out on each of the dependent variables using chain length and chaining strategy as independent variables. Before analysing the data it was necessary to make an adjustment for unequal cell numbers. This was done by the method of expected equal frequencies as outlined by Ferguson (1966). Where overall chaining strategy reached the ·05 level of significance, differences between the means of each dependent variable for individual strategies were examined by Scheffé's (1953) multiple comparison method. Because of the relatively small number of scores in each group, the more rigorous significance level of ·05 rather than ·10 recommended by Scheffé (1959) was chosen.

Tables 1–3 give the means on each dependent variable and the bracketed pairs indicate differences significant at the above level.

TABLE 1

MEAN TOTAL TIME TO REACH CRITERION (MINS.).

Chaining Strategy	Motor Chains			Number Chains		
	Short MI	Medium MII	Long MIII	Short NI	Medium NII	Long NIII
Whole Method (WM)	19·27	45·10	90·18	21·46	58·13	86·42
Forward Chaining (FC) ..	21·41	58·53	88·56	17·66	48·01	86·64
Backward Chaining (BC)	25·38	64·22	98·68	28·01	63·39	85·41

TABLE 2

MEAN TOTAL NUMBER OF PROMPTS TO REACH CRITERION.

Chaining Strategy	Motor Chains			Number Chains		
	Short MI	Medium MII	Long MIII	Short NI	Medium NII	Long NIII
Whole Method (WM).....	0·76	3·14	6·45	2·70	11·50	27·85
Forward Chaining (FC) ..	0·45	3·38	5·68	2·56	12·26	49·20
Backward Chaining (BC)	2·16	5·55	11·82	4·17	18·77	39·46

TABLE 3

MEAN NUMBER OF TOTAL SPANS TO REACH CRITERION

Chaining Strategy	Motor Chains			Number Chains		
	Short MI	Medium MII	Long MIII	Short NI	Medium NII	Long NIII
Whole Method (WM)	7·85	21·42	38·25	10·35	36·00	69·42
Forward Chaining (FC) ..	9·60	28·66	59·62	11·62	41·84	94·05
Backward Chaining (BC)	10·83	29·66	57·70	13·23	44·33	75·60

These results can be summarised as follows :

(1) There was a general trend for FC to be better than BC on acquisition measures for the motor chains and the short and intermediate number chains with the difference reaching significance on ' total prompts to criterion ' for MIII ($P < \cdot 05$).

(2) For the long number chain the general trend was for BC to be better than FC with the difference significant on ' total spans to criterion ' ($P < \cdot 05$).

(3) On ' total time to criterion,' differences between strategies for each chain length failed to reach significance, although for the motor chains WM overall was significantly better than BC ($P < \cdot 05$).

(4) On ' total number of prompts to criterion ' there was a trend in favour of WM compared to BC.

(5) For the intermediate and long motor chains WM required the practice of significantly fewer spans than BC and FC ($P < \cdot 05$). For the number chains the trend was in the same direction, the difference between NIII/WM and NIII/FC being significant ($P < \cdot 05$).

EXPERIMENT 2 (RETENTION)

Method.

Subjects and design. The subjects were the same and arranged in the same groups as in the first experiment. The aim of the experiment was to see how well subjects remembered the motor and number chains which they had learned one week previously. Independent variables were chain length and previous chaining strategy used. Dependent variables were time to criterion, trials to criterion and prompts received on all trials.

Procedure. Subjects attempted the motor chain first. If subjects needed to be prompted by referring to the instructional booklet, these prompts were recorded on a special sheet. The chain was practised until it could be done to a criterion of one perfect (i.e., promptless) trial. Immediately after this, subjects began the number procedure by working through the same criterion booklet used in the previous experiment. As before, any prompts needed were recorded in the booklet. Practice continued until the procedure could be completed without prompting. For both chain tasks time of starting and completion were recorded.

Results.

Further loss of data occurred during this experiment due mainly to absences. For the motor chains full data was obtained for 158 and 161 subjects and for 147 and 152 in the case of the number chains.

The same method of statistical analysis was employed as in Experiment 1. Tables 4–6 give the means on each dependent variable.

TABLE 4

MEAN TIME TO REACH CRITERION RETENTION STAGE (MINS).

Previous Chaining Strategy Used	Motor Chains			Number Chains		
	Short MI	Medium MII	Long MIII	Short NI	Medium NII	Long NIII
Whole Method (WM)	4·90	11·98	21·77	9·36	18·11	36·74
Forward Chaining (FC) ..	4·18	12·12	18·83	7·99	19·37	29·87
Backward Chaining (BC)	4·71	17·73	22·14	9·66	21·39	30·68

TABLE 5

MEAN NUMBER OF TRIALS TO REACH CRITERION (RETENTION STAGE).

Previous Chaining Strategy Used	Motor Chains			Number Chains		
	Short MI	Medium MII	Long MIII	Short NI	Medium NII	Long NIII
Whole Method (WM)	1·38	1·70	1·79	2·05	2·44	3·80
Forward Chaining (FC) ..	1·16	1·65	1·47	1·84	3·00	3·89
Backward Chaining (BC)	1·22	2·00	2·13	2·25	2·70	3·00

TABLE 6

MEAN NUMBER OF PROMPTS RECEIVED ON ALL TRIALS (RETENTION STAGE).

Previous Chaining Strategy Used	Motor Chains			Number Chains		
	Short MI	Medium MII	Long MIII	Short NI	Medium NII	Long NIII
Whole Method (WM)	0·42	1·25	2·63	1·55	3·72	10·70
Forward Chaining (FC) ..	0·21	0·88	1·33	1·30	5·94	10·68
Backward Chaining (BC)	0·27	1·55	2·13	2·18	5·17	8·00

This data may be summarised as follows :

(1) In the retention stage there was a significant advantage in favour of FC over BC for the motor chains, ($P < \cdot 05$), although the differences between the two strategies for each chain length separately did not reach significance.

(2) Differences between the strategies on the retention stage measures of trials and prompts were in favour of FC for the motor chains, although none for any chain length reached significance.

(3) In the case of the number chains there was a trend in the retention stage in favour of BC on trials and prompts for NII and NIII but differences were not significant.

DISCUSSION

The main aim of the investigation was to examine the effect of chain length and chaining strategy on the acquisition and retention of chains and the finding that FC was superior to BC for motor chains (at least for MIII) is in agreement with that of Johnson and Senter (1965) using verbal chains. It is also of interest to note that the experiments comparing backward and forward fading (Scott, 1968 ; Duncan, 1969) showed a trend favouring the forward method. The failure to find an advantage in favour of BC over FC, at least for the motor chains and the short and intermediate number chains, merits some explanation. It may be, as Cox and Boren (1965) suggest, that the human learner can hold a long-term goal in mind and that this can act as a reinforcer for each stage in a task which the learner perceives as leading to that goal. However, the reinforcing power of holding the goal in mind may very well be less for chains which are long and in which the parts cannot easily be seen as meaningfully related to that goal. The latter would seem to apply particularly to the number chains in comparison with the motor. In practising the motor chains under normal progression the individual stages come increasingly to resemble the anticipated end product. In similarly practising the number chains the relationship of each stage to the final result is less clear.

For the motor chains the trend in favour of FC may be explained as a result of performance under BC being depressed as a consequence of the unfamiliarity of the strategy. There is, after all, something a little disturbing about a method which goes completely against our normal notions of serial progression. It may be that with longer chains the learner will have greater opportunity to overcome such feelings and acquire an appropriate learning set. Thus, a trend in favour of BC with long chains might be expected. Some indication that this might be so is suggested by the data for NIII. Some caution must be exercised in accepting as a real effect the reversal in the order of effectiveness of FC and BC for NIII but such a possible ' reversal ' is worthy of further investigation.

The finding that acquisition under WM was better than FC is directly contrary to the conclusions of Johnson and Senter (1965) in their Experiment III. Thus, it would appear that one is not justified in generalising the findings of experiments using less meaningful material to those dealing with more meaningful material. The advantages claimed for the repetitive part method (forward chaining) are that it reduces interference and facilitates inter-item differentiation (Postman and Goggin, 1966). However, these advantages may be less important with material having greater internal organisation. Indeed, Naylor (1962), in his review of part-whole learning, suggests that for tasks of high organisation, whole practice tends to be favoured as task complexity increases. Since in the present experiment the motor chains can be regarded as of moderate to high organisation and the three chain lengths as points on a continuum of increasing complexity, then Naylor would predict that with increasing chain length WM would tend to be favoured. This prediction is, in fact, consistent with the findings of the experiment.

The failure to find significant differences between strategies for any of the chain lengths in the retention stage for both motor and number tasks was consistent with the experiments of Johnson and Senter (Experiment III, 1965) and Hartley and Woods (1968). However, it should be noted that these two experiments and the one discussed here involved relatively short retention periods, which may, as Duncan (1971) has suggested, have been too short to reveal any difference which overlearning might have obscured.

In short, if the findings of this experiment are taken in conjunction with those of others dealing with backward chaining and fading, then there is little evidence for the belief that a cumulative retrogressive method has any inevitable advantage over other methods.

At the present time then, teachers and instructors should be advised neither to adopt backward chaining in any doctrinaire way nor to reject the method out of hand. Rather, they should regard it at least as a potentially useful component of their teaching armoury.

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CRITICAL NOTICE

METHODS OF EDUCATIONAL ENQUIRY

THE OPEN UNIVERSITY. EDUCATIONAL STUDIES: A THIRD LEVEL COURSE

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Block 1. *The nature of educational research*
Block 2. *Research design.*
Block 3. *Data collection.*
Block 4. *Data analysis.*
Block 5. *Experiment in educational research.*
Block 6 *Evaluation and assessment of educational research*

The six blocks which are considered in this review constitute the elements of a half-credit course taken in the third year of the Open University's degree in Educational Studies This is a 16-unit course in which Educational Enquiry counts for 2. The blocks ought to be read in relation to the set texts and the television and radio programmes which constitute other essential elements of the course; in some senses this poses an immediate problem for a reviewer. It is as if one is being called upon to review not so much a text-book or a work of scholarship but an individual lecturer's set of lecture notes. Lecture notes are not the complete presentation of a course; they rightly call for much supplementary reading on the part of the student. They reflect, too, a personal style of teaching which may not necessarily or immediately have to meet the canons of error-free scholarship. They may, especially in an introductory course, be rightly concerned more with stimulating a first interest, with giving a broad sweeping over-view, with revealing ultimate aims and purposes albeit dimly in the context of the student's initial state of ignorance The aims of all courses and of all lectures may be much the same; the acceptable norms and standards within a field may be agreed by all. But the methods by which these aims are achieved are as many and diverse as there are lecturers.

These blocks do, nevertheless, have to face a difficulty which the usual lecturer and his notes do not; this is the lack of immediate student feedback. That immediate adaptation which is available to the lecturer at the sight of the excited, agitated or bemused faces of his class is not there in anything like the same sense for our colleagues who wrote these six blocks. To that extent one has to read them on the one hand as being no more than the lecture-note framework on which the course is built yet on the other with a degree of severity and with a concern for detail more appropriate for a work of scholarship. The fugitive ephemerality of the spoken word is not an advantage available to any great extent to the Open University.

One looks for and immediately finds in these six blocks all the features of presentation and style which have been so distinguished an element of the Open University's course books. An elegant layout and typography, built-in topics, exercises small and large for periodic self-assessment, glossaries, definitions of aims and objectives, proof-reading approaching perfection, and many other attributes, not least, in this case, the subtle sequential commentary of the six covers. All these have rightly made such publications notable and influential in many quarters, including universities far removed from Bletchley.

The first block is general and introductory, speaking in a fairly leisurely way of scientific method, of the proposed emphasis of the course on survey rather than on experimental research (an emphasis from which it later veers in the fifth block), of the limitations of research in education and of the manner in which the research worker sets about his task. All is sound and sensible and makes good use of Entwistle and Nisbet's recent book, *Educational Research in Action*. There is proper stress on the imaginative element involved in research which no course can teach, slightly blurred by an unhappy contrast at one point between ' research ' and ' intuition ' ; there is also recognition, honestly faced in a course which is to emphasise survey work, of the weaknesses of the *ex post facto.* A nice analogy between, in so many words, repeated measures designs and the hysteresis cycle in magnetism has been put in the reviewer's own analogy-store for future use. The block finishes with a reprint of Bantock's somewhat tedious and misinformed article called " Educational Research : A Criticism." This was doubtless intended fairly to reveal to students the existence of contrary and counter-balancing arguments. It might better have been placed with the other three papers in the final block, Block 6, as being suitable for critical analysis.

Thereafter there appears only the glossary, which is as useful and as limited as any attempt to define concepts in dictionary style must inevitably be. ' Concomitant Variation ' speaks of *parallel* variation where perhaps *joint* variation would have been preferable. And a laudable intention to provide useful cross-references by means of a ' see also ' column breaks down (and after Block 2 is abandoned) for want of entries.

The second block is concerned with research design though not in the more usual manner in which this phrase is used, namely through the medium of analysis of variance designs or in the Campbell and Stanley sense. Here the discussion is principally on hypothesis formation and on sampling, still largely within the context of survey research. There is, in the discussion of the former, proper emphasis on the essential need for hypotheses to be negatable ; sadly this modern outlook is fogged by some old-fashioned notions that conjectures can be used to *explain* observations when, in fact, they can only describe them, and that scientists are concerned with causality. It also seems that a rather Euclidean notion of ' proof ' has overlaid the word's proper meaning, namely ' test.'

Sampling is generally well dealt with and the discussion of the various types of sampling is particularly good and appropriate at this level. Sampling is stressed as a means of securing representativeness ; one might have emphasised additionally its function in securing equivalence. This follows, of course, from the principle of representativeness but is too often forgotten by research workers as they madly, and so often improperly, hunt around for matched samples. Survey and *ex post facto* is the claimed underlying theme of this course and it is workers in these fields who are particularly prone to the matching madness. More regrettable, however, is the lack of emphasis on the single most important purpose of sampling, randomly secured, namely, as the only proper means of obtaining an estimate of the error against which any claimed findings have to be judged. Indeed, throughout the course this basic principle that findings must be viewed against the error in the situation is rather underplayed. The principle applies no matter what type of research is being conducted and should never be far from the front of the research worker's mind.

We also get in this block a first hint of the part that the standard error concept is to play in the course. It will be more appropriate to return to this later.

Block 3 is a substantial chunk of work. It deals with the practical aspects of data collection, with the principles of measurement, with test construction and with some of the kinds of data-gathering instruments which are available. Some of this constitutes the more routine and dreary part of any course on research methods. It tends to take on the attributes of a mail-order catalogue when it is not a series of hints and tips. In the present case the authors have done unusually well. This is partly due to their manner of linking the text with a project and with quite extensive exercises or ' activities.' The exercise towards the end of section 3 which requires a detailed analysis, including a technical analysis, of a paper which hit the headlines of the popular press a few years ago, is particularly good.

The concepts of reliability and validity loom properly large in this block. There is a very good exercise on the manner in which different potential sources of error variance affect the different types of reliability coefficient. Elsewhere, though, the discussion is generally adequate without being very penetrating or very modern.

Thus, the construct validity discussion is limited and concentrates more on the validation of the theory than the validation of the test Even here its discussion takes little account of the negative or zero correlations which the construct may imply and which properly need to be tested. Possibly because the orientation of the writer of this section was towards the appearance of positive instances rather than negative we get no mention of the multi-trait/multi-method approach to validation. More regrettably the unifying concept of variance is hardly given a chance to operate. So much of reliability and so much of validity coheres—as do so many other topics—when they are seen in variance terms. It is true that the variance formula for reliability makes a brief appearance (immediately to be displaced by standard error considerations), but it is never used to give any meaning or any unity to the reliability and validity concepts. Not unexpectedly in this situation, generalisability in the Cronbach sense is not even whispered Thus again the concern with standard error has overlaid what should have been a more proper concern with variance—in this case error variance, and it is perhaps now appropriate to enlarge on this point.

Variance, its partition and its control, along with the associated notion of co-variance, constitutes the single most important unifying concept in the field of study with which we are here concerned. It is, first of all, a major descriptive statistic. Thereafter, experimental design is concerned with all those factors which affect the variance of the dependent variable, with the maximisation within it of the part which is due to the independent variable or variables, with the control of extraneous components and with the minimising of error elements. Reliability and validity are each concerned from different viewpoints with the properties or identification of various parts of the total variance of a test. So also factor analysis deals with those parts of a test's variance which are common to other tests. And analysis of variance speaks for itself even though we shall have to return to it and speak more loudly for it when dealing with Block 4. One can only repeat at this moment that it is a pity that, with all the new thinking which has gone into so much of the Open University's work, it has missed an opportunity which too many of us before have failed to grasp.

These remarks notwithstanding, the block gives a good survey of data collection methods with a particularly appropriate emphasis on tests of all kinds as means rather than as ends. And as usual the block finishes with a glossary which is of considerable use to the student (especially in a work which has no index) even though it includes the now dirty words ' culturally disadvantaged ' and puts a limited gloss on ' culture-free ' when it defines it as being independent of language.

Block 4 deals with data analysis and presents, if the mutterings of students already on the course are any guide, a sharp upward gradient of difficulty. It always does, mostly because students generally come forward with such a Pilgrim's load of mathematical inhibitions on their backs. The block is, in fact, well written, with an easy style and a frequent appeal to simple analysis and examples.

It lays down from the beginning its purpose as "inventing useful ways of looking at things " which is fair and agreeable enough. For the novitiate the meaning of ' useful ' might have been expanded, possibly in terms of the search for relationships and differences that might lead ultimately to prediction. It rightly has no truck with so-called qualitative data and puts a proper emphasis on numbers. It properly stresses, too, that data is analysed for a purpose and that purpose is not to be seen as a branch of logic. There is an early stress on the predictive aspect of correlation with which so much survey work is concerned.

If one were going through the work with the authors line by line and as an external advisor there would be many points of detail which one would wish to argue or for which to suggest some alternative formation. Such detailed consideration is inappropriate here but there are certain features which cannot be passed over. The first of these relates to their treatment of multiple regression (pages 60 to 70) and the stress they lay on a study of Peaker's which constitutes a chapter in the Entwistle and Nisbet text of required reading. Much of this treatment is excellently done and especially the use of the Venn diagrams which inform the margins. The discussion is excellent so long as it sticks to multiple correlation.

But when it shifts its orientation towards the notion of the ***relative importance*** of the various independent variables it moves on to shifting sand. The notion of " independent contribution to the variance " has no meaning when the independent variables are correlated and it is about time that an embargo was put on interpreting multiple regression equations as if this were not so. It will be necessary to make a further brief comment on multiple regression when considering the analysis of variance treatment of Block 5.

The second reservation of the present writer is in the treatment of factor analysis and the perpetuation of the unnecessary distinction between factor analysis and components analysis Whether, theoretically, one is correlation orientated or variance orientated the practicality of the situation is that amost everybody uses the first few terms of the latter as an approximation, and a very good approximation, to the necessary terms of the former. It is unnecessarily pernickety to write as if specific factors must always exist; one need only speak of the ***unanalysed parts*** of the variance of each test in a battery. These may be specifics; they may, alternatively or more generally, be factors not easily determined from a given battery (including specifics) or be too small to be of interest in the framework of a particular study. And, incidentally, the text speaks of a multiplicity of models and methods when one would have thought that the actual number of models was rather few, and Varimax is a method of rotation rather than a method of factor analysis.

The third area of subject treatment which might be looked at with a fresh eye when the time for revision and re-writing comes round is the treatment of standard error leading to the notion of t-testing. Every standard error formula has a square root sign in it and this is a fair indication that there is a more fundamental formulation around somewhere Consideration of error variance rather than standard error brings the discussion of error into the general framework and consideration of variance rather than making a separate topic of it. But further, it eliminates the need for any discussion at all, except for historical purposes, of the t-test as a technique for comparing means. Editors of learned journals in this field may be shocked at such lese-majesty; but all who have taught will know the plaintive cries from the beginner or the innumerate, " Which of all these formulae for the t-test do I use ? " The answer is " None of them." The 2-mean case is but a particular example of the several-mean case. All of them, whether based on random groups, matched groups, repeated measures or what have you, can be handled in a routine and generalisable manner by a straightforward application of the analysis of variance. As stressed earlier, variance and its analysis (and control) is what underpins almost everything that is done in educational research; the more one can keep this in mind the greater the unity of the subject and the fewer the difficulties for the student.

All these matters represent differences of view-point as to the teaching of the subject. With the task with which the Open University is faced consideration of teaching methods must rank very high. There are many points in the present block where the teaching is most excellently done. The importance of trends in results is properly stressed; so too is the preference for parametric tests (in the face of much absurd recent pressure almost to ignore them); though over and above the power of parametric tests more might have been made of their robustness and their infinitely greater flexibility. Bayes receives an appropriate passing mention; and the summary of conclusions and warnings at the end of part 3 of the block is only surpassed by the excellent final summary (given the caveats entered above) which brings the block to a close. It ought to be read before the course begins and periodically thereafter. But all teachers and students in this field have permanently to face the dilemma of being just about in a position to embark on the course by the time they have finished it.

In Block 5 the course temporarily (and properly) leaves its survey-research orientation and takes a brief look at experiments. In keeping with common practice it more or less equates experiments with designs amenable to analyses by the analysis of variance technique. Somebody soon will have to give a good shaking to this excessive limitation. The text is easy to read, the prose being written in so easy a style and the line of argument so uncluttered. The contents are, alas, rather restricted ; this is perhaps understandable in the context of this survey-type course. But partly it stems still from the boa-like constrictions of the t-test. There is even an inappropriate multiple t-testing application following an F-testing which is rather naughty in these days of proper planned or *post hoc* comparisons. Indeed, much more might have been done on the whole topic of following up a significant F. The significance in terms of the reduction of uncertainty is a point in mind. Possibly this is taken up in one of the supporting broadcast programmes which has the " Significance of Significance " as its title. But as a whole it must be said that the treatment of analysis of variance is too brief. More space can easily be found for it if the t-test is eliminated. The block finishes with a brief but cogent discussion of the generalisability of experimental results, this being a distillation, appropriate at this level, of the Campbell and Stanley internal-external validity argument. In the concluding discussion following this, the writer at one point seems to suggest that the physicist and the behavioural scientist are engaged in different kinds of enterprise. If one takes the view, as this course rightly does in so many words at the beginning of Block 4, that basically a behavioural scientist is in a parameter-estimation situation, then the differences between physicists and ourselves are only differences of degree. The figures for the speed of light or for the coefficient of expansion of iron still have to have their plus and minus figures attached, relatively smaller than anything the social scientist can attain, but still there. At several points in the course these supposed differences of approach are given passing but exaggerated reference.

The final block in the course, Block 6, presents three papers with common themes of the relationships among attainment, family background and personality. These are offered in their original format and for analysis and comment. Thereafter the course team makes its own comments, using, *inter alia*, comments by R. R. Dale and M. Chazan The ability critically to analyse research articles in the learned journals is perhaps the single most important skill that a course of the present type can induce ; it would certainly take precedence at this level over the production of skilled research workers. This manner of bringing the course to its fulfilment is highly to be praised, and the comments of the course workers are thorough and perceptive.

There are perhaps only two points which they seem to have missed. The first of these stems from points made earlier in this present review when touching on multiple regression. The course tutors comment, with a modest degree of hesitant criticism, on the loss of subjects when the authors of the second paper moved from correlational analysis of their data to an analysis of variance of the same data. What they refrain from saying is that this loss came about because the two authors, in moving to an analysis of variance, moved to a design which was *inappropriate* to their data. Data which have to be degraded by converting them into two or three broad categories, data resulting from ' treatments ' which are not manipulable by the experimenter (as intelligence, family size, personality and so on are not manipulable), and data which have to be 'lost' so that equal numbers of subjects may appear in the various cells of the design, are data which are not appropriately analysed by analysis of variance at all Multiple regression will take into account the results of all the subjects as they stand without dropping cases and without arbitrary categorisation , it can do all that analysis of variance can do in the present case (including interactions) and in this case, can do it better. If, as it must now seem tedious to repeat, a greater unity had been given to the course by an emphasis on the concept and treatment of variance, and if multiple regression and analysis of variance had each been brought under this rubric as related techniques whereby variance is predicted or partitioned or controlled or analysed, then this weakness in the second paper would have been clear to see.

The second point which the course team seems to have missed is that the author of the third reproduced paper seems to have miscalculated almost all his Kolmogorov-Smirnov test figures.

Overall, this set of course books represents a perfectly reasonable half-credit course, presented with all the flair which one has come to expect of and to respect in the Open University, stylish typography, immaculate proof-reading, a text liberally interspersed with projects and with periodic self-assessment tests, careful control of bibliography and most valuable recapitulations and glossaries. It shows perhaps some signs of hurried writing and periodically it reveals a somewhat dated approach. Sometimes this may be due to a wish not to make the course any more difficult. In the writer's opinion this is a mistake. Undergraduates of the Open University are as well capable of taking on a meatier course and the major modern concepts in this field as are undergraduates elsewhere. There are certainly some elements missing from this course or only momentarily touched upon which a modern undergraduate in this field ought to know about At other times the dated appearance is more in an occasional lapse in the method of teaching.

There is, in particular, some failure to utilise unifying themes ; variance has been stressed as one ; the fact that *all* statistical hypothesis testing is a comparison of the outcomes of the experiment with the error inherent in it is another. Teaching methods are, of course, personal and nobody has any authority to interfere in the teaching methods adopted by another person. But, as one teacher to another, the writer suggests that there are some devices which might be worth looking at when the course is revised. It is to the credit of the Open University that this takes place fairly frequently.

Finally, one may say that in the pleasure of reading the course, interrupted only now and then with tooth-grindings and arms flung heaven-wards, one has been forced more and more to wonder why the course comes so late in the total three-year course the undergraduate has embarked upon. Understanding of the type which this present course provides must so inform the whole of this three years' work that it should surely come earlier than as a third-level course.

BOOK REVIEWS

ANDERSON, J. R., and BOWER, G. H. (1973). *Human Associative Memory.* Washington : V. H. Winston, and New York : Wiley, pp. xiv+524, £7·50.

Electronic computers and their software have furnished new intellectual tools and led to new species of scholarship. In the family of psychologists, one such new species has evolved within the theory-building genus that, until recently, was best exemplified by the learning theorist. This new species, the 'computerist,' devises information-processing systems to function in the likeness of people, and it faces a problem which learning theorists could avoid. How represent the stored body of knowledge, the 'memory'?

The present book, by two able computerists, seeks to decompose this problem into two sub-problems, namely a core storehouse and variable mnemonic strategies which search that storehouse. The authors recognise that such a decomposition is contentious and that "the Gestalters and the reconstruction theorists asserted that it was impossible to extricate memory from such matters as problem solving and inference" (p. 141). Nonetheless, they have a good try for an information-processing system that might do the trick. The system's data-base is HAM (an acronym of 'human associative memory') which stores representations of abstract propositions linked together into an associative network. Within the total system, HAM is sandwiched between components that translate sensory events into propositions, and components that search HAM to generate recognitions, recalls, and answers to questions. The book is a meticulous exploration of HAM's system, and might be nicknamed 'ruminations on a HAM sandwich'!

The early chapters discuss theory construction, computer simulation, psycholinguistics, and the associationist tradition and its counter-traditions. Then follow computerisable details of HAM and how HAM's system might mimic performances given by intelligent adults in laboratory tasks involving the learning and remembering of words and sentences. There are reports of original experiments on sentence learning and question answering. Overall, this scholarly book charts an impressive, and still unfinished, piece of analytic exploration. It will excite research computerists. But it provides little for psychologists in general, e.g., nothing is said directly about educational, clinical, developmental, social, or biological aspects of memory, nor about individual differences

Let me conclude with two general comments First, the opening chapters champion an associationist view of memory and are critical of reconstructionist views such as those of Bartlett and Neisser (and I might add Piaget). However, it would be a misreading to conclude that reconstructionist views are seriously undermined. The criticisms are made possible by assuming a sharp theoretical distinction between the components of 'memory' and 'mnemonic strategy.' This distinction is legitimate in constructing simulation devices but,when we look at flesh-and-blood people in process of learning and remembering, we are never able to isolate two such components cleanly from each other. As always, we must carefully discriminate various meanings of the portmanteau word 'memory.' Second, the computerist species is typically skilled in propositional thinking but casual about the human functioning which is to be illumined. The present authors are more psychologically sensitive than most computerists and hint that the species is emerging from its idiot-savant stage of development.

IAN M. L. HUNTER.

BOND, G. L., and TINKER, M. A. (1973). *Reading Difficulties: Their Diagnosis and Correction.* (3rd edition.) New York: Appleton-Century-Crofts, pp. vii+604, $12·05.

It must be said right at the beginning that this book gives a clear, sensible exposition of the nature and development of reading and of approaches to helping the child with reading difficulties It is a text which could be put into a student's, or teacher's, hands with some degree of confidence insofar as it is based on careful appraisal of theory and well thought out practice. However, it is also rather dated and almost totally preoccupied with the American scene.

The book is intended for all concerned with children who have reading problems, whether minor or severe. It is divided into six parts covering fundamental principles of reading instruction, the nature and causes of reading disability and the diagnosis and treatment of reading problems in the ordinary classroom, the remedial classroom and the clinic. The stress throughout is on individual differences in performance and on the multiple causation of reading disability. The latter term is defined as an ineffective approach to coping with printed material despite school-based opportunities to acquire reading skills.

The original publication date of this volume was 1957 and, although the authors claim that recent research on reading and discussions of new methods and materials have been added, the present edition remains more a classic in its field than a contemporary appraisal. The system adopted of numbering references rather than indicating the year of publication can be misleading in this respect. A quick survey of the titles listed in the References section in the appendices revealed that approximately 65 per cent of them were published between 1916 and 1959 There are 12 references in the 1970s, three of them from the report on the proceedings of the International Reading Association in 1970.

The survey of the References section also revealed the paucity of consideration given to British work. Two books are listed (Hinshelwood, 1917, and Vernon, M. D., 1957), one monograph (Collins, 1961) and a handful of articles, mostly on remedial teaching and on i.t.a. Admittedly the survey made was rapid and some references may have been missed. Even so, while it is useful for the reader with a fairly extensive knowledge of British contributions to have access to some less well-known American work on reading, the book's value for students in training in this country is called into question.

For those who wish to experience for themselves the quality of the text and the type of presentation employed, one of the best chapters, that dealing with the basic principles of remedial instruction, is reprinted in *Reading: Problems and Practices* (Ed. Reid, 1972), an Open University set book.

It is a pity that, unlike wine, reading texts on the whole do not improve with age. Nevertheless, a study of Bond and Tinker's book does bring home how long-standing some of the current issues in reading are and how much creditable research has already been carried out on them

ALICE F. LAING.

BUTCHER, H. J., and RUDD, E. (Eds.) (1972). *Contemporary Problems in Higher Education: An Account of Research.* London: McGraw-Hill, pp. 401, £7·20.

Twenty years ago this reviewer's modest proposal to study the relationship between A-level physics results and B.Sc. physics performances was gently vetoed as infringing university autonomy. Times have changed. In 381 pages and 28 chapters of *Contemporary Problems in Higher Education* there are 616 references to studies relevant to higher education in Great Britain Allowing for repetition, this represents a real explosion of research in six major fields: (*a*) selection and academic performance; (*b*) experiment and innovations in methods of teaching; (*c*) the changes students undergo during the course of their studies; (*d*) student unrest; (*e*) the government of institutions of higher education; and (*f*) economic and manpower considerations. An introductory chapter by the editors and two general reviews of the current scene in Great Britain (perhaps more correctly, England and Wales) set the stage. But for the most part the sub-title, 'An account of research,' describes the contents of this volume more accurately than the main title. Indeed, the account seems to obscure rather than illuminate today's pressing problems in higher education. Why?

Certainly the competence of the contributors cannot be questioned. An impressive array of distinguished leaders in the field of higher education and senior research workers cover ground which they themselves have made familiar to us. From such editors and authors readers could rightly expect original and penetrating analyses of problems, illuminating accounts of the factors giving rise to them, and careful assessments of possible outcomes from alternative solutions. These high hopes were disappointed. Much of the material has been published elsewhere in extended form but has not been re-written so as to open up new ideas for research. With notable exceptions (Halsey and Trow on the 'British University Teacher') the analyses lack bite and suffer from the absence of identifiable conceptual frameworks. Most of them are disappointingly parochial (but see Malleson on student wastage, Woodhall on finance and Psacharopoulos on the profitability of higher education). Accounts of present conditions lack novelty—the chapter by Blackstone and Williams is an exception. Research seems to have inhibited rather than liberated most of the authors.

Perhaps the editors' terms of reference made contributors eschew the things to be looked for in this volume. They were, the editors wrote, "empirically orientated, and most chapters describe empirical research rather than the philosophical analysis of educational objectives . . ." (p. 8). Could it be that this is a false dichotomy? And that philosophical analysis should be an integral part of research in social sciences? Or is it that the models of empirical research represented in this volume are now increasingly questioned by philosophers of science and the natural scientists? Or is it the lack of an explicit conceptual model for the volume as a whole and the absence of such models in most chapters which account for my disappointment? Or is it that times have not changed quite as much as we think and that some issues in the politics of higher education remain too sensitive for the research worker to touch unless he be an Ashby or a James?

The volume is, of course, full of interesting conclusions. Take a random sample. Success in higher education is essentially unpredictable (p. 69). However, motivation is a better predictor of success than admission grades (p. 79). Interviews favour applicants with high scores for 'oral aggression,' 'unconventionality,' 'creative interests,' 'feminine interests' and organisation and leadership (p. 162). Once students have been admitted wastage rates are generally unacceptably high and in some university departments tend to be very high indeed (p. 83, p. 91). Applied scientists are more neurotic and conservative than pure scientists, while mathematicians are particularly introverted (p. 66). Students in residence prefer to be in residence, non-resident students prefer to be non-resident (p. 189). Students in residence, however, tend to have a higher average of 'university leadership' than students who live at home (p. 188). As for the control of higher education, the ideas and ideals of the university are increasingly at variance with its organisation (p. 208) and democracy must be clearly defined if it is to be cited in serious discussion (p. 267). Finally, what a student learns at a university has little relevance to his future occupation (p. 229). At the same time the possession of a Ph.D. is increasingly becoming a criterion for the selection of university staff (p. 230).

This random selection of conclusions represents what Ashby is quoted as calling "miniscule analyses" which are "so secondary to the prime purposes of a university" (p. 310). They are held together in this volume by a preoccupation with the influence of social class, and assumptions about wastage rates, staff-student ratios and the tutorial system. Many questions about the structure of higher education, the content and sequence of courses, and the position of professional studies in relation to 'academic' subjects, are treated incidentally. Certainly this account of research is not viewed in the light of what the prime purpose of the university is or ought to be.

This is surprising in view of student unrest in the sixties which erupted into a violent denunciation of modern society and its universities. Pompidou claimed that the events of May, 1968, in Paris placed at risk the future of civilisation. A Gallic exaggeration ? Perhaps. But at the time personal letters from and discussions with colleagues abroad testify to the gravity of the situation in many universities. In this volume the caution of the review of student unrest in England and Wales is based on a desire to get the facts straight but takes little account of several penetrating analyses made of the aims students were expounding, their tactics, and their successes and their failures. The castigation of journalistic reports, which at least said something, may well divert attention in this country from an unsolved problem For it should be remembered that radical students throughout the world rejected the reform of either society or the university in favour of revolution.

The students raised questions about the prime purpose of the university Their revolt threw up many issues for philosophical analysis and research. Should the university be the detached critic of its host society ? Or a base of political activism ? And what will be the consequences for society if a sizeable minority of young people in massively expanded higher education are encouraged to be critics of society ? How can the traditions of autonomy and academic freedom be incorporated into a system of public accountability ? Should the university remain a self-governing community ? And, if so, can it claim the right to oversee professional training ? Perhaps a new direction will now be given to research in higher education If so one awaits the next account of it with interest. Meanwhile *Contemporary Problems in Higher Education* will be a useful reference book rather than a stimulus to think afresh about major issues in higher education in Great Britain.

BRIAN HOLMES.

CAZDEN, C. B., JOHN, V. P., and HYMES, D. (1972). *Functions of Language in the Classroom.* New York and London : Teachers' College, Columbia University, pp. 394, c. $9·50, p. $5·95.

This book comprises a collection of papers, most of them original, designed, in the words of one of the editors, " . . . to illuminate the communicative demands of the school and the sociolinguistic discontinuities between a child's home community and his school culture " Thus, although the various authors (mostly American) write from the viewpoint of different disciplines (psychology, sociology, linguistics and anthropology), the papers are linked by a common focus upon language behaviour in the context of teacher-pupil interaction. Moreover, they show that the cognitive or referential meaning conveyed by language should not be studied apart from its social or behavioural contexts despite the fact that, traditionally, the science of linguistics has tended to do this. In a clear and authoritative introduction, the linguist Dell Hymes stresses that it is crucial that we should learn how language serves social functions such as conveying implicit information about the social status and roles of speakers and their attitudes and intentions concerning each other.

Hymes provides a critical and integrative summary of the papers in this volume which is divided into three parts. The first of these, 'Perspectives from Non-verbal Communication,' consists of two papers, one concerned with non-verbal aspects of communication in the classroom, e.g., through gesture, facial expression and eye contact, and the other with the communication problems of deaf children, particularly those who do not first learn sign language.

The second part, 'Varieties of Language and Verbal Repertoire,' comprises papers dealing mainly with the relationships between standard and non-standard speech forms (dialects) in several societies (but especially American Negro communities), and the ways in which members of a given 'speech community' may alternate between these forms and styles of speech in different social contexts. This section includes Bernstein's previously published paper 'A critique of the concept of compensatory education' in which he asserts that 'restricted code' speakers sometimes use more elaborated speech forms. A common theme in these papers is that non-standard forms of language are *not* intrinsically inferior to standard forms from either a linguistic or a cognitive viewpoint. Uses of language, these authors argue, should be judged according to their appropriateness to their particular contexts and purposes and not in terms of their approximation to standard usage.

The third section, 'Varieties of Communication Strategies,' focuses primarily on patterns of speech used by teachers and pupils in those classrooms where there is a clash between the cultural and linguistic norms of the school or the 'mainstream culture' and those of the communities from which the children come. These papers, most of which deal with American Indian communities, show how such a clash can lead to a gradual breakdown in teacher-pupil communication.

In the light of the current controversy regarding the philosophy of compensatory education four papers are of particular interest. The first, by Leacock, challenges the view that the speech patterns of 'middle-class' speakers of English are 'abstract' in style, in contrast to the 'concrete' style of lower-class speakers. The latter speakers, she claims, are equally capable of more abstract uses of language but these occur in different contexts and modes from those characterising 'middle-class' speech forms. For example, the elaboration of the metaphor is a notable feature of black speech style This argument appears to contradict Bernstein's assertion in the following paper that lower-class children tend to be orientated toward 'particularistic' forms of meaning which are context-bound, i.e , relatively *concrete*. In the third paper Kochman argues that lower-class Negro dialects are *potentially* just as capable of expressing abstract logical thought as standard English and that Negro children should be taught in school to use more elaborated speech forms in their own dialects as well as in the standard form. Thus he advocates a policy of linguistic and cultural pluralism. Finally, in a paper describing the predominantly visual learning style of Navajo Indian children, Vera John questions the current educational emphasis on the development of verbal language as the universal medium of learning and abstraction and puts forward a tentative case for encouraging the development of non-verbal imagery and thought in certain groups of children.

This book would not make easy reading for those unfamiliar with some of the basic concepts of linguistics and sociology. However, a careful reading of it could help the teacher to a greater awareness of the social significance of patterns of language use, particularly in those situations where the cultural norms of children deviate from those of the school. Some of the papers suggest possible ways in which teaching methods and curricula could be adapted to take account of such subcultural norms, e.g , a greater emphasis upon co-operative learning situations for American Indian children. However, apart from Bernstein's article, the papers have only indirect application to 'working-class' children in Britain, and one is left hoping that similar ethnographic classroom-based studies will soon be carried out on this side of the Atlantic. Since it deals predominantly with the social rather than the referential and cognitive functions of language, this book would have been more aptly entitled 'Social Functions of Language in the Classroom'

THEO COX.

CHAZAN, M. (Ed.) (1973). *Compensatory Education*. London: Butterworth Group, pp. 154, £3·50.

Although there is a vast and rapidly increasing body of literature on compensatory education in the USA, very little has been written on research and experiment in this field in Britain. This volume is, therefore, doubly welcome for it not only fills the gap but does so in a most competent fashion. It consists of five papers given at a symposium on 'Compensatory Education' held during the 1970 annual conference of the British Psychological Society, but these papers have been expanded and updated and now boast comprehensive bibliographies.

A very high standard is set in the first paper, by Maurice Chazan, which examines the concepts of disadvantage, deprivation and compensatory education in a sound and scholarly fashion. The issues involved are summarised, areas of concern delineated and work in the USA, UK and Israel reviewed. Unfortunately, this standard dips somewhat in the next chapter—'Compensatory Education in the Nursery School,' by H. L. Williams. This contains discussions of the major pre-school compensatory education programmes, a great deal of which is a repetition of the previous chapter and should have been excised. The author's confusion of scientific theory and received doctrine obfuscates the issues involved. The last part of the paper briefly describes the NFER pre-school project. As this project raises important questions about the value of the traditional nursery school curriculum for disadvantaged children its theoretical foundations should have been more clearly described.

Phillip Williams follows with an account of the work of the Schools Council research and development project in compensatory education, which is concerned with identifying the needs of infant school children who are at risk because of material and cultural deprivation. This is careful and painstaking work with clearly defined, well thought-out long-term goals. The account is precise, accurate and useful. The fourth contribution, by Paul Widlake, describes some aspects of the work carried out by EPA action research projects in several parts of the country. This chapter is unique in the volume for it contains first-hand accounts of parents and children involved in the projects. Their living conditions are vividly described by the author and an extremely perceptive teacher comments on the reactions of a group of deprived children confronted with a wide open space for the first time. These insights breathe life into the dry bones of psychological theory and statistical analyses, and form one of the most salutory sections of the book.

Gerald Williams and David Morton provide a very stimulating and thought-provoking chapter in which they consider ways in which the education and training of teachers may be structured to help disadvantaged children. The areas covered are related to teachers' attitudes in the classroom, the learning styles of the children and the development of an appropriate curriculum. The authors have suggestions to make both for initial training and the in-service 're-education' of more experienced teachers. In the last chapter the threads are drawn together in the editor's closing contribution which not only summarises the preceding pages but distinguishes those lines of action holding out most promise for the future. These include an emphasis on the pre-school child, remedial work in the infant school, improved school facilities for secondary pupils and an expansion of counselling facilities. The provision of teachers' aides and parental involvement schemes are discussed and in a final salvo the re-distribution of national resources to better alleviate need and finance more research is advocated.

This is an excellent volume. There are hard facts, ideas a-plenty and thoughtful, incisive analyses of problems. Both the interested amateur who wishes to survey the field and the professional concerned with the implications of work being done will find much that is interesting, stimulating and provoking.

HELEN QUIGLEY.

DAVIDS, A. (1972). *Abnormal Children and Youth: Therapy and Research.* New York: John Wiley and Sons, pp. xii+211, £5·30.

This book is based upon and is the product of Dr. Davids' long experience and practice in the fields of therapy and research. It is divided into four parts:

(i) residential treatment and behaviour modification with severely disturbed young children (chapters 1–2) ; (ii) psychological studies of emotionally disturbed children in transition (chapters 3-4) ; (iii) personality, psychotherapy and special education of adolescent underachievers (chapters 5–9) ; (iv) accomplishments and challenges (chapter 10).

The objective of the volume is to present selected topics (which are very wide ranging for such a small volume) to illustrate the meaningfulness of research and practice not only for the graduate student but also for the clinician. The scientist-practitioner model presented in the volume boldly departs from traditional forms of ' design and experiment ' and relies upon a looser approach and narrative form that many would prefer to elaborate statistical designs.

The author's philosophy seems to be the only common factor among the wide ranging subjects selected in this volume. After reading the report of the effectiveness of residential treatment for psychotic children, one might feel encouraged at the way behaviour modification techniques were applied with these difficult children although there is hardly anything new in the applications as such. And the acceptance of limitations of procedures and effectiveness of treatment are honestly spelled out. The part relating to ' emotionally disturbed children in transition ' appears to be straightforward comparisons of the ego functions of ' normal and disturbed ' children, with special reference to the study of their level of aspiration, and the author has here greatly relied upon his own past and present experiments and their clinical importance.

Part three, in spite of its limitations and flaws in data presentation, is most revealing and useful insofar as the practical issues and application of clinical techniques are concerned 'Academic Potential Project' for underachieving boys of junior high school age would help any one involved in work with such children to understand the factors associated with the poor achievement of those young people. It is a pity that the treatment programme left out ' the study of attitude of fathers ' because the personality characteristics of these underachievers cannot be fully perceived by simply assessing the ' child-rearing attitudes of mothers ' Perhaps similar projects could be usefully, but with certain modifications, undertaken with disturbed youngsters in Britain.

The book can be recommended to all concerned with disturbed children and their treatment. The author's acceptance of ' limitations and ignorance ' about ' the perplexing abnormalities ' adds to his human stature as an ' explorer ' and practical-research-scientist.

RASHEED AZAM.

De Bono, E. (1972). *Children Solve Problems.* London : Allen Lane, The Penguin Press, pp. vii+227, c.£2·50, p. £0·80.

This entertaining work presents samples of the solutions offered by children to a number of novel problems such as Stop a Cat and Dog Fighting, Weigh an Elephant, Build a House Quickly, Improve the Human Body, A Bicycle for Postmen, Policemen and Badmen. The solutions are presented in graphical form and reveal an originality which, the author claims, is destroyed by formal education.

Some features recur in the proposed solutions to the several problems. One is the noticeable directness with which the children come to the problem. This is often assisted by their comparative ignorance of technical difficulties, but the proposals are always emphatic The weight of the elephant is too great for ordinary household scales, so four separate scales are suggested, one for each foot Another suggestion is to hoist Jumbo aloft by helicopter while a giant spring balance records his weight. The design of the postman's bicycle recognises many practical problems There is a small aircraft engine to help him over hills, heated handlebars and a windscreen for the Winter, a quiet radio which will not disturb others and an extensible arm equipped with boxing glove to beat off dogs. The trailer embodies compartments for parcels and the sorting of letters. Improvements to the human body involve additional arms, eyes in several directions, additional legs against the possibility of injury and even spring legs for better goal-keeping.

Awareness of psychological and practical problems of living is always evident even if technical comprehension is naive and moulded by push-button conceptions from the visual media. The reader is forced to the conclusion that if children are capable of such a range of imaginative invention, such exercises could be used as the first stages for projects in the teaching of physical and general technical principles or more frequently involved in plans advocated by the author, namely, training in thinking. Much would be gained if the presentation were related to the existing literature on children's thinking

F. V. SMITH.

DOWNING, J. (1973). *Comparative Reading : Cross-National Studies of Behaviour and Processes in Reading and Writing.* New York : Macmillan, pp. 595, £8·50.

The rationale behind this ambitious volume is that cross-national study can help us to " understand better the fundamental psycholinguistic processes of reading and writing and the way in which they develop." Professor Downing emphasises the need for a controlling theoretical perspective, the lack of which reduced the value of some earlier studies, and devotes Part I of the book (256 pages) to the exposition of " a model for literacy acquisition."

Essentially the model focuses on the effect of linguistic, cultural and educational variables on the cognitive processes of the learner. Downing discusses each set of variables at considerable length, displaying a remarkable width of knowledge in marshalling his evidence. Not all his interpretations will go unquestioned, but he presents a valuable synthesis of current knowledge, in a readable form, with generous use of quotation In addition to Downing's nine chapters there are two other contributions to Part I. Blom and Wiberg contribute an updated account of their cross-national study of attitude content in reading primers (an earlier version appeared in the *International Journal of Psychology*) Brimer gives an optimistic survey of the methodological problems, in which he concludes that sophisticated statistical techniques will " give a new lease of life to comparative education " · Insufficient detail is given to allow the reader to share his optimism, but the test case, it seems, will be the forthcoming IEA survey of reading comprehension.

Part II, consisting of 13 chapters by national experts on reading in their respective countries, reproduces the material on which the analysis presented in Part I was based. The writers worked not to the model of literacy acquisition (nor, indeed, with the new methodology) but to a loose framework provided by Downing. The quality of the contributions varies. Any work of this nature runs the risk of being, to some extent, dated by the time it is in print. Thus, Goodacre's admirably lucid and genuinely British chapter is understandably pre-Start and Wells, but one is disappointed to find in a previous chapter a diagram of the French system of education based on information published in 1961. Again the authors vary in the degree to which they adhere to the prescribed framework—and this obviously influences the ease with which comparisons can be drawn. Elkonin's chapter on the USSR ignores the framework completely and presents a reworking of his ideas on the problems of sound analysis already available in B. and J. Simons (1963) *Educational Psychology in the USSR.* The Hong Kong contribution is perhaps too committed to an analysis of the Chinese writing system whereas the Japanese authors manage to make a few telling points without stretching the reader's knowledge of comparative linguistics too far. The interdisciplinary nature of the study of reading is reflected in the comparative lack of reference to material distinctively psychological.

Apart from fairly regular reference to reading disability by most contributors, Che Kan Leong makes a gallant attempt to apply experimental findings of Western psychologists to the reading of Chinese—ascribing, incidentally, the early experiments of Erdmann and Dodge (1898) to Woodworth—and Biglmaier includes an interesting historical account of reading research in Germany since Helmholtz.

Professor Downing's contributions to Part I constitute more than a simple analysis of the data presented in the national chapters To take only one example, in discussing the linguistic environment he devotes considerable attention to Osterberg's study of dialect problems in Sweden, a study not mentioned in Malmquist's disappointing national chapter. Thus, if the publisher's apparent attribution of the entire volume to Downing seems less than just to his associates, to accord him only the editorship would be even more unjust. In an otherwise admirably produced book it is unfortunate that proof-reading should lapse in the diagram of the literacy acquisition model; only polyglot readers can comment on the accuracy of Chinese ideograms, Hebrew, Hindi and Japanese scripts. Not everyone will want to work their way through the second part (however rewarding) but most students of reading will want to read Part I. The high cost will, unfortunately, limit availability.

RONALD FYFE

ENGEL, M. (1972). *Psychopathology in Childhood.* New York: Harcourt Brace Jovanovich, pp. 183, £1·35.

The book opens with a prologue giving the history of Lee Harvey Oswald who assassinated President John F. Kennedy. The case history serves to illustrate the inadequacy of the mental health services for children in the United States, but the kind of problems this boy had and the difficulty of enabling such a child and his parent to make use of the resources of help available to them is all too familiar.

The purpose of *Psychopathology in Childhood* is to acquaint the student with some facts, issues and problems in clinical psychology today. Selected topics are presented in the general framework of three foci: the social, diagnostic and therapeutic aspects of mental illness in children.

In the section on social aspects, several important topics are raised, such as the corrosive impact of poverty on the mental health of children. Perhaps to a greater extent in the United States than here, between the time of birth and entrance into school, children from low income families disappear from public view and yet, by that time, many of their mental health problems are consolidated. The desirability of attempting to monitor the welfare of young children, in the interests of identifying emerging health and mental health problems before they can massively affect and ruin children's lives, is discussed. The rapid development of group care facilities for young children with the opportunities and difficulties it presents for early identification of mental health problems is also discussed, and there is an interesting section on the historical changes in child-rearing patterns.

In the section on diagnostic aspects the area of psychotic disorders is discussed in detail and is followed by a consideration of one of the psychoneurotic disorders. The description of psychosis, based on the GAP definition, is very lucid and the subsequent consideration of some major theorists in the field of psychotic disorders in childhood (Bettelheim, Des Lauriers, Goldfarb and Mahler) gives the student an insight into various approaches to the theories and treatment of psychosis. There is a discussion of psychoneurotic disorders in children, intended to give an overall view of some major ideas pertaining to the origin and structure of neurosis. Brief as this introduction to a complex topic is, it is clearly stated and points the way to future study by the student. The case study of obsessive-compulsive neurosis in childhood which follows is well used to illustrate the processes discussed earlier.

In the section on therapeutic aspects the aim is to present the student with a general view of the therapeutic aspects of clinical work with children. The shape of the area of child therapy is examined in broad outline and four forms of therapy, psychoanalysis, intense psychotherapy, family therapy and 'project re-ed,' are examined in more detail.

The book covers a remarkably wide field in a competent and concise way. It should arouse interest in helping young people afflicted by mental illness. While it describes the American scene, it is of general interest, though the references, which are almost entirely to American literature on the subject, may prove rather frustrating to British students.

SHEILA C. CUMMING.

FEIN, G. G., and CLARKE-STEWART, A. (1973). *Day Care in Context.* New York: John Wiley, pp. xxi+359, £5·80.

The authors, two research psychologists at Yale, whose main research interests are in the field of child development, present a summary of research findings which, in their opinion, should inform and improve day care provision; day care, here, may be understood in terms of the non-parental care of children up to the age of six years, and 'care,' in turn, is to be interpreted broadly, to include education.

Their book is divided into four 'contexts,' i.e., 'Day Care, Past and Present,' 'The Child,' 'The Family' and 'Education.' Included in these four contexts is a very wide range of important topics. Context I presents some historical perspectives and raises policy issues; only the American scene is surveyed. Context II looks at the child's 'social world,' discusses 'the mystery of language,' 'reconsiders play' and looks at 'the problem-solving child' and 'the changing child' The third context, amongst other things, looks at the forces affecting and the diversity in, family functions and structure, the physical environment, values, attitudes, goals, child-rearing and maternal behaviour. The final context looks at different educational programmes, issues in implementing, evaluation and 'opportunities and dangers.'

Perhaps one's first reaction, on reading this densely-packed book, is that the authors have attempted too much and have aimed at too wide an audience. Because they attempt so much—virtually a complete coverage of all the important issues in the development and education of the pre-school child—their discussions of research findings have to be highly condensed. This means that the reader without a lot of knowledge in a particular area, or the reader who does not have the time and energy to follow up the references, must take on trust the authors' summaries. Possibly such readers will be the practitioners in the field, i.e., the nursery school staff, play group organisers, 'professional' parents and the like. Such readers are those most likely to be interested in the practical implications of research findings and the authors do, in fact, attempt at the end of each section to make the connections between theory and practice. Two obstacles get in the way of this intention First, as the authors concede, contradictory research findings may often confuse rather than clarify practical procedures. Secondly, the authors insist on the importance, in day care, of considering ***individual*** children's needs when planning programmes; this makes the application of research findings, couched in ***general*** terms, even more difficult.

The great strength of the book for this reviewer is its extensive (over 800 titles) and up-to-date bibliography. At each point of the discussions, the reader is given enough reference material to enable him to decide which references are worth pursuing. As a source-book for any student of young children's development (and one includes here any busy practising educational psychologist who wants to keep up to date) this book should prove to be extremely useful.

DAVID EVANS.

FRIEDMAN, R. (Ed.) (1973). *Family Roots of School Learning and Behaviour Disorders.* Springfield: Illinois. Charles C. Thomas, pp. xiv+346, c. $14·75, p. $9·50.

Although the role of the family in the causation of children's school-based problems has already received considerable attention, much of the literature has been at a fairly superficial level, so that there is still a place for a book of this kind, which seeks to explore in some depth the links between family dynamics and school difficulties. In spite of the involvement of as many as 12 contributors, representing the viewpoint of psychiatrist, psychologist, psychotherapist and social worker, skilful editing by Robert Friedman, himself responsible wholly or partially for four chapters, has ensured that the volume is well-organised and coherent

The book is divided into four parts, dealing with aetiology, diagnostic techniques, clinical treatment and intervention centring on the school. Saul Brown opens Part One with a lively discussion of family psychodynamics which is greatly influenced by the Erikson model of developmental crises but presented in a well-balanced way. This is followed by a concise review of the literature on the relationship between factors in the family and learning disability by Robert Friedman and David Meltzer, and a consideration by the former of the impact of family stress and disorganisation on a child's behaviour at school.

In Part Two, the editor gives an interesting account of his own techniques of interviewing children and parents, emphasising the importance of clarifying parental expectations of the child as well as the child's perception of those expectations. In this connection, the nine categories outlined on pages 92-94 seem to offer a useful framework for looking systematically at data obtained through structured interviewing. Mortimer Myer adds a brief but informative summary of psychological tests found to be of value in studying the influence of the family on a child's development.

In Part Three, we are given a balanced view of treatment possibilities, a variety of approaches being suggested, with pleas for combined educational and clinical approaches in dealing with young emotionally disturbed children and for a careful re-examination of traditional methods of treating children presenting problems at school. In the final section, some sensible ideas are put forward for working with parents of pre-school and older children, including the handicapped.

All the contributors write lucidly and economically, and all show an awareness of the complexity of the issues discussed, avoiding glib and easy solutions. Group as well as individual approaches to treatment are considered, with illustrations from relevant case-histories. Educational psychologists who, while recognising the importance of the family in causing learning disabilities and other problems in school, have perhaps not always given sufficient thought to their own role in the guidance and counselling of parents, can learn much from this book. Indeed, everyone concerned with education and mental health should find it readable and stimulating

MAURICE CHAZAN.

JENSEN, A. R. (1973). *Educability and Group Differences.* London: Methuen, pp. xiii+407, £3·90.

Professor Jensen's latest volume is a considerably enlarged version of the discussion and review he presented in 1969 in his *Harvard Educational Review* article, concentrating particularly on the problem of the Negro-White disparity in measured intelligence. In spite of much attack, Jensen is unrepentant about his former conclusions, and he is concerned here to amplify his argument and rebut his critics.

The argument starts from the 15 IQ point difference in mean measured intelligence between American Negroes and Caucasians and about this there is no dispute. It passes next to the substantial contribution of heredity to the variance in intelligence within white and black groups. There is also little dispute about this, and although some may put the hereditary variance at 80 per cent and others prefer to bring it down to 50 or 60 per cent, the precise figure has little relevance to Jensen's argument. This fact in itself does not, of course, prove that genetic factors are involved in the white-black IQ difference, but it does show that one must consider them.

The argument now takes a different tack. It is not possible to demonstrate directly beyond all shadow of doubt that American Negroes have a genetically different potential for intelligence than American Caucasians. The strategy, therefore, is to take the environmentalists' explanations in turn and demolish them. Hence much of his book is devoted to a consideration of the environmentalist position and Jensen takes us through the evidence that the Negro IQ could be depressed by low average, socio-economic class, impoverished environment, relatively poor schooling, teacher expectancy, low motivation, culture-biased tests, language deprivation and malnutrition. His conclusions are that in no case do any of these environmental variables stand up as plausible explanations of the Negro-Caucasian IQ difference.

So, in the end, we are driven to one or other of two conclusions Either the difference is determined largely by genetic factors, or it is determined by an unknown environmental factor X, hitherto unidentified but consisting perhaps of some subtle technique of child rearing practised by Negro mothers, some peculiar dietary substance consumed in Negro households, etc., etc. How far it is plausible to postulate the presence of factor X is essentially a matter of judgment, particularly the judgment of people who have experience and expertise in the field of intelligence and intelligence testing Whatever the situation may be in the United States, in this reviewer's experience most psychologists with expertise in this area in the United Kingdom are agreed that Jensen is probably right in discounting factor X and placing the burden of the explanation on genetic factors. The issue is not unlike the controversy which followed the publication of Darwin's *Origin of Species*, when some churchmen argued that God had deliberately planted the fossils of apparently extinct species to make it look as if evolution had occurred ; man's faith was thereby being tried. These churchmen just could have been right, but the trouble was that their theory defied judgment and commonsense in much the same way as the environmentalist's mysterious X factor as the cause of Negro-Caucasian differences in IQ seems increasingly to defy judgment and commonsense today.

R LYNN

KRAUS, P. E. (1973). *Yesterday's Children*. Chichester: Wiley, pp. 191, £5·00.

This book presents a study of 165 children starting kindergarten in 1953 in two New York City schools, one in a low middle-income area, the other in a depressed area. Eighty-five were followed through into senior high schools and some into college.

The aim was to answer such questions as : "Are there patterns in children's learning experience ? How early are symptoms of maladjustment displayed ? How early does the level of achievement become fixed ? When is promise of giftedness identifiable ? "

Intelligence and achievement tests were periodically administered. Teachers assessed intelligence, adjustment, sociometric status, drawings, handwriting, and wrote anecdotal reports. Children and parents answered questionnaires Data and case studies are systematically presented and interpreted. It was discovered that teachers' knowledge of children's measured intelligence did not seem to influence their own judgments of intelligence

The evidence suggests that there should be deep concern at the end of the 3rd grade when reading patterns become rather fixed for children with reading difficulties. Reading achievement correlated highly with subsequent intelligence and achievement tests and was generally predictive of later educational success Competent teachers, without intensive help from a remedial specialist, were unable to break fixed reading patterns Children repeating grades did not make as much progress as those promoted and teachers' judgment of class performance, along with achievement test scores and measured intelligence, was more predictive of success than were test scores alone

The author states that " It is a sobering thought to realise that, in spite of the combined efforts over a 10-year period of school personnel, and sometimes in spite of psychiatric help, the behaviour of many of the children with problems could have been predicted in the primary grades." He concludes that providing special help only for emergencies precludes the possibility of establishing long-range preventive and treatment programmes. However, it was found that when children experienced a traumatic shock, such as the sudden death of a parent, in no case was there any apparent effect upon learning or adjustment. Mobility of children had less effect on growth and achievement than did the causes of such mobility such as movement into different socio-economic situations

Project staff communicated with parents through questionnaires on attitudes to school Many parents sought interviews which facilitated good relationships. The author believes that this points strongly to the need for personnel, not regular school staff, to whom parents can turn for advice and comfort

The title of the book is somewhat misleading because the data mainly relates to Grades 1 to 9, after which the children dispersed to many different high schools. Then the author worked alone with consequent restriction of data collection. However, 64 students answered a questionnaire on completion of Grade 12 and there are a few references in reported case studies to those aged 25 years.

The book should be of interest to those engaged in, or planning, similar studies. The study lacked a control sample, any specific hypotheses and rigorous statistical analysis. The project staff actively participated in the educative process and the ' Hawthorne effect ' must have influenced outcomes

ROY HARRIS.

LOMAX, D. E. (Ed.) (1973). *The Education of Teachers in Britain.* London : John Wiley and Sons, pp. 467, £5·50

This book is a considerable contribution to the topical discussion on improving the quality of training for teachers, following the recommendations of the 1972 James' Report. Indeed, it forms an excellent reference framework for this report as far as future developments are concerned The seven parts of the book cover the development of teacher education in universities, polytechnics and colleges of education and looks at values, curricula, in-service training (in-service education ?), the economics of teacher education and research It draws upon the valuable experience of 20 involved educationalists, who show a deep concern for standards and values in the future

This review can obviously only consider points raised by a few of the contributors, but at a time when the Association of University Teachers has labelled the Diploma of Higher Education as an academic non-starter, and many colleges are deserting traditional university validation for the Council of National Academic Awards, it is refreshing to be reminded by Brian Holmes at the end of Chapter 2 of the many opportunities for positive development that do exist in teacher education. James Scotland's contribution describes the excellent Scottish system and shows clearly how there have been important changes in traditional approaches to teacher education

There is an excellent historical account of the university departments of education and the role of colleges and polytechnics, with a critical assessment of the future David Aspin writes convincingly on the ' educated ' person and deals well with the problem of values in teacher education showing how Bantock's version of the teaching concept is necessarily a limited one that few actual teachers would subscribe to, although there is " more than a grain of truth in Bantock's analyses."

Peter Renshaw's plea for a flexible curriculum for teacher education is familiar ground, but he discusses a valuable occupational structure, " The supplemented teaching force " (attributed to Dr. Joan Tough of the Leeds Institute) The use of aides, ancillaries and teacher assistants in classrooms needs exploring, despite possible teacher union resistance, and there is a relevant and urgent plea for the establishment of curricular priorities in both initial and in-service education.

Part 5 deals with the urgent problem of in-service training, probably the most diverse and, in some ways, disorientated aspect of teacher education Arguments about the probationary year will continue, whoever is responsible for ' supervising ' it, and teachers have many doubts about compulsory in-service courses when so many of them have always attended voluntarily. Tom Hollins makes the point that although schools are provided for the benefit of pupils they must also satisfy the teachers. This certainly applies to the attractiveness of in-service provision, irrespective of the motives of the teachers. There can be no room for tired ideas, ill-informed speakers and constantly going over old ground. This is summed up completely by Michael Pollard, an educational journalist : " If I hear any more about Piaget, I'll walk out "

It is a very comprehensive book and the editor has succeeded admirably in stimulating interest in the immediate further study of the complex problems of teacher education.

PETER PRINCEP.

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MARCUS, J. (Ed.) (1972). *Growing Up in Groups: The Russian Day Care Centre and the Israeli Kibbutz.* New York : Gordon and Breach, pp. 295, £6·25.

This fascinating book consists of the manuals written by professionals respectively for the child-care workers in Soviet day care centres and metapelets in Israeli kibbutzim. Both countries have provided early group care for pre-school children for several decades, and these manuals contain the distilled wisdom of their separate experiences.

The first section, " Play and activity for children in the first three years of life," by Kupriyanova and Fedoseeva, is a step-by-step guide through the child's early intellectual, motor and sensory development. A section is devoted to each year, areas of development carefully described and activities to encourage this development meticulously explained. Clearly, the Soviet nurse is seen as a pre-school teacher and this is her curriculum guide. The activities cover the usual areas story telling, modelling, painting and drawing, singing and dancing, listening and talking. There is even time for trips to the fields (' Goal : to collect flowers and to examine butterflies, dragonflies, etc.'), blowing soap bubbles and catching sunbeams in a mirror. The role of the adult is seen as central in promoting healthy development, especially in the field of verbal behaviour. This contrasts with the situation in Western countries where experts feel that cognitive and moral development proceed automatically from experience, as by osmosis.

The second section of the book, " Methods of kibbutz collective education during early childhood," by Professor Yona Ben-Yaakov, contains much more familiar material. This general purpose manual is intended to provide the overall framework by which the metapelet can build healthy relationships with the young child and his family and establish the routines that lead to a smooth, effective upbringing It rather resembles an abbreviated ' Dr. Spock ' for the kibbutz, a gentle blend of common sense, psycho-analysis and *Nursery World.* The emphasis is on play and toilet-training rather than education.

To the outsider one of the most intriguing aspects of this book is the way it highlights the differences in attitudes and expectations between the two cultures. For instance, in Israel " one should not try to establish ' periods of concentration ' with groups of children until the ages of 2½ to 3 years," but in the Soviet Union children of 1 to 1½ years are sitting in semi-circles furiously singing amusing songs and increasing their vocabularies. Again, a sizeable proportion of the instructions to the metapelet concern relationships with the child's parents and, in particular, the rights of the mother. Soviet children do not appear to have mothers.

I would recommend everyone involved in working with, caring for, or teaching small children to read this book, not only for its intrinsic interest but for the light it casts on our own practices. Both these cultures reflect aspects of current British practice ; their contrasts highlight and accentuate these aspects but enable one to form a different picture of the whole scene. This is definitely one of the most fascinating books to be published in the pre-school area in recent years.

HELEN QUIGLEY.

FARLAND, H. M. (1973). *Intelligent Teaching*. London : Routledge and Kegan Paul, pp. ix+145, c. £2, p. £1

Since the main purpose of this book is to help beginning teachers to increase their adequacy in the classroom, the reviewer considered that the most relevant comment on its effectiveness would be from teachers in the early stages of their careers. Accordingly, the book was passed to four young teachers · two about to embark on the second teaching practice of their Dip.Ed. year, and two who had been teaching for just under a year. The following are extracts from their comments :

On its relevance . " The chapter on discipline was very good because it didn't tell you what to do, but told you how to work out what to do " " The section where he pointed out the possible reasons why children didn't have much respect for me as a teacher was an eye-opener. I just thought children would like to be friendly." " I couldn't understand a lot of it, but the parts I could understand made me think about what I was doing."

On its practicability . " It was a typical academic's book—all about being thoughtful and thinking about assumptions. I tried to ignore it—you don't have time for that." " I found it refreshing. Australian teachers aren't encouraged to think very much and this made me feel that teaching was an important job. I've used his way of thinking about things and it works." " It is a pity he didn't give a few more tips Just the sort of thing you could look up what to do when you are busy."

On its readability : " It was heavy going at times · what's an ' apophthegm ' for God's sake. He really does mean us to know he's literate." " Most of it was readable but he really does know some long words " " I really had to concentrate on it."

These are probably sufficient comments to indicate that it had a mixed reception. My view was that it is a very worthwhile book—it tried to lead teachers into the practice of generating practice from theory, and *vice-versa* · to generate a cycle of think-operate-think again. If it only partially succeeds in this then it is worthwhile. But I agree with one of the students in that it does tend to call a spade an agricultural implement, and its sentence structure tends to hinder rather than help. Nonetheless, it would be a valuable book for teachers in training to read, preferably in a group setting since it raises very discussable questions.

Its value for teacher trainers who are just beginning would be equally great. It would open their eyes to the openness of what kind of practice is good practice, and would give them a rational basis from which they could develop their own ' theories ' of supervision

JOHN GARNER

McMaster, J. McG. (1973). *Toward an Educational Theory for the Mentally Handicapped*. London: Edward Arnold, pp. 134, £2·00.

The transfer to education authorities of responsibility for the education of severely subnormal children has presented them with a new and largely unknown problem. Though there has been a long history of endeavour to teach the mentally handicapped, prior to April, 1973, little thought had been given by educationists to its aims and objectives. The result is, as always, a tendency to think of the new in terms of the old, with all its inherent dangers—in this case preoccupation with the minority of ' borderline ' children, projection of goals for the former ESN group, and emphasis on ' remedial ' approaches.

This exclusion from the educational system, which now seems so indefensible, had its rationale in the concept of incurability. The earliest recorded attempts at teaching in Western Europe were made by doctors, Itard and Seguin, who saw an educational approach as the most likely ' cure ' for mental deficiency; in England some schools for mentally handicapped children were established from 1870 onwards but these, like the day occupation centres resulting from the separation of subnormal children into educable and ineducable groups by the Mental Deficiency Act of 1913, were under medical supervision and, therefore, cut off from the main stream of educational development. At any stage in between, the intervention of teachers, with stress on planned progress rather than cure and on what constitutes educational development within the context of permanent care, might have been beneficial.

McMaster has strong feelings about " this educational neglect ,bordering on the criminal, with regard to the mentally handicapped " (p. 21). " Educators, in the main, have considered the area of mental handicap unworthy of their attention and effort as a result of misconception, ignorance and erroneous thinking." No credit is given to education authorities or to teachers for their welcoming gestures towards the children and for the remarkable progress in the short time since ' the transfer.'

It is likely that a prolonged period of interaction of theory and practice will be necessary before we achieve the sense of purpose and feeling of dynamism which today characterises normal education. However, no one would deny the need for " a conceptual framework which will allow a holistic view of a fragmented, unstructured and largely chaotic field." This book is opportune in contributing to the development of a more realistic, systematic and co-ordinated approach towards meeting the educational needs of these children, which is not the exclusive preserve of any one profession or discipline.

Initially, McMaster examines in detail the legal—administrative concept of mental handicap and then draws on contributions from several fields—history, psychology, philosophy, sociology, medicine and psychiatry, and political, economic and social studies—as component elements on which an educational theory for the mentally handicapped should be based. Central to the task of formulating such a theory must be an attempt to make clear the basic differences between schools of thought within the various subject disciplines, but McMaster frequently misses the opportunity to mention important alternative approaches. We learn nothing about the impact on the day-to-day existence of a family of a handicapped child, what problems they face, and how they cope with them, or of the attitudes of other people towards the mentally handicapped; we tread the familiar path of certain psychological theories, education practices, and history of state involvement, but there is little reference to the ' societal backcloth ' emphasised by the author. Quotations are made freely, if a little uncritically, so that the impression is given of a *pot pourri* of material from a variety of sources, but no evolution of a unified conceptual structure or reorganisation of the field in a way which may elicit new insights or give a rationale to guide our decision-making, clinical or administrative.

McMaster makes a strong plea for systematic planning in the education of the mentally handicapped based on the clarification of aims and of objectives, but restricts this narrowly: he has nothing to say about the need for greatly improved services called for in the DHSS White Paper of June, 1971, " Better services for the mentally handicapped"—or for the co-operation and co-ordination of the disciplines on which he draws Insufficient attention is given to new developments—family support, guidance and counselling, parents' workshops, etc. This book does, however, contrast sharply with a number of recent publications by teachers in this field which in the main consist of compendia of activities or descriptions of skills of various types. It provides a useful bibliography, though with startling omissions—nowhere could I find reference to the work of Gunzberg, Kushlik or N. O'Connor.

What then of its relevance ? Changes in society have forced on teachers the need to re-think ideas about what constitutes a suitable curriculum for the primary and secondary schools. The same is true of a special school—but based on which theory, and who is to decide upon aims and methods in any one school ? McMaster emphasises the relevance of operant conditioning to this field, yet a school employing behaviour modification techniques will not lend itself easily to a variety of different regimes under the one roof. Can *all* members of staff be involved in planning at *all* levels ? Does an educational theory for the mentally handicapped need to be different from an educational theory for other groups of children ? The book raises the questions, but there is little to help us towards answers.

A. GORTON.

MERRITT, J., and MELNIK, A. (Eds.) (1972). *Reading : Today and Tomorrow. The Reading Curriculum.* London : Univ. of London Press, pp. 510 and 560, £1·25 each.

These two volumes of readings have been designed as part of the Open University post experience course on Reading Development The first volume (*Reading : Today and Tomorrow*) attempts to answer the questions of what reading is and what the present state of reading is ; the second (*The Reading Curriculum*) is on teaching and development of reading proficiency and the evaluation both of reading proficiency and the reading curriculum. Given such a coverage the editors feel that these books should be useful background material for other students (in initial or in-service training) and for those interested in the teaching of reading. Is this the case ?

To begin with, like most collections of readings, the constant changes of styles of writing, of basic assumptions and of backgrounds do not make for ease of reading. A great deal of American material has been included and, although notes on the structure of the education system in the United States is given, constant reference to, for example, grade levels can be a distraction for those who have to translate them into age levels. The organisation within schools and within classrooms appears to be incompatible with much British practice. From some papers, too, one has the impression that reading has been equated with living and even that those who cannot read are, in some respects, not full human beings—an attitude likely to cause irritation.

Further, one assumes that those who are following the Open University course are given some guidance on the relative importance of the many papers, but, for those coming ' cold ' to the readers, the introductions to each section are not enough and make a quotation from a paper by Strang (*Reading · Today and Tomorrow*, p. 89) particularly apt " Books densely packed with facts dissatisfy even the superior readers who must struggle in organising the material to select key sentences and words from the crowded pages."

However, much is to be gained from persisting. For example, that 'reading' is no simple concept is well pointed out by two papers in *Reading : Today and Tomorrow* which are not easily accessible to the British reader—by Jenkinson on ' Sources of knowledge for theories of reading ' and by Robinson on ' Significant unsolved problems in reading.'

Few people have yet considered what reading means to the child. Therefore, the section on ' Reading development and the reader ' is important as it includes several papers on what children think about reading.

It is the second volume, *The Reading Curriculum*, which is more likely to appeal to intending teachers. Important for pointing out that what teachers think they are teaching may not be what the children are learning is the paper by Downing on 'Relevance *versus* ritual in reading.' Nor are the learners lost sight of in the section on diagnostic teaching. The section on assessment does rather show up the British tendency to consider reading to be the province of the infant school as the papers on assessment beyond the beginning stages are, with one exception, American.

Both volumes seem to presuppose a somewhat idealised teaching situation but, on the whole, provide useful, if not always easily readable, information on reading and the teaching thereof.

JENNIFER STEWART.

NAUMBURG, M. (1973). *An Introduction to Art Therapy : Studies of the 'Free' Art Expression of Behaviour Problem Children and Adolescents as a Means of Diagnosis and Therapy* (2nd edit.). London and New York : Teachers' College Press : pp. 12+225, 100 illustrations +8 in colour. (No price stated.)

In these days, when art therapy is rapidly finding its way into clinics and mental hospitals, many people look for some clear guidance as to how it can be carried out Dr. Naumburg provides the answer because she was a pioneer in the work at the time when this book was first published, in 1947, and she followed it up with three other books, one devoted to the art of psychoneurotics, one to that of schizophrenics and one to the principles and practice of dynamically oriented art therapy.

The present book deals with several cases—children with behaviour and neurotic problems—and sets forth in detail the circumstances and history of each case, the way in which the child's spontaneous picture-making was utilised by the therapist and the outcome.

Dr. Naumburg writes in a fascinating way about each child and reveals her great therapeutic and diagnostic skill and insight on every page. The book, although no doubt inspired by dynamic and depth psychology, does not call for intricate or specialised knowledge of psycho-analysis. It is written in such a way that every person interested in art therapy can be absorbed in it and learn from it.

It is hardly surprising that Dr. Naumburg was the first to receive the award of the Ernst Kris Medal recently instituted for annual award by the American Society for the Psychopathology of Art. There are two points of minor criticism, however, which perhaps should be mentioned. In her revision of the book Dr. Naumburg has not provided it with an index, and she does not appear to have brought it up to date by detailed references to the many recent publications on psychopathological art and art therapy in several parts of the world, which her readers might have wished to follow up.

R. W. PICKFORD.

PIAGET, J., and INHELDER, B. (1973). *Memory and Intelligence*. London : Routledge and Kegan Paul, pp. xii+414, £5·25.

BATTRO, A. M. (1973). *Piaget . Dictionary of Terms*. Translated and edited by RUTSCHI-HERRMANN, E., and CAMPBELL, S. F. New York : Pergamon Press, pp. xiv+186, £5·75.

Memory and Intelligence opens with the author's distinguishing 'memory in the wider sense,' from 'memory in the strict sense' The former consists of the conservation of schemes, that is, those parts of actions or operations that can be generalised to other situations ; whereas the latter refers to recognition or evocation of objects or events now past. In evocation, the memory image is particularly important Memory in the strict sense is then looked at in relation to other cognitive functions. This leads on to two basic hypotheses. The first suggests that memory in the strict sense is the figurative aspect of memory in the broad sense ; while the second indicates that the code used for encoding and decoding stored information changes as new operative schemes are constructed.

There then follows the details of 20 experiments involving a study of memory in children whose ages ranged from 4 to 15 years. The tasks involved remembering various logical, causal and spatial structures, and their details, with the analysis of the experimental results, take up the major part of the book. The upshot for the authors is that memory is a special aspect of intelligent activity concerned with reconstructing the past. Memory in the broad sense provides the code (dependent on the schemes available) which organises the data at retention and recall. But this organisation of the data is modified by intellectual growth, so that recall of some situations may be more accurate after, say, six months than on immediate recall because of the growth of more complex schemes in the interval. At the same time memory in the narrow sense supports the available code with memory images.

Readers may find the introduction somewhat difficult unless they are familiar with Genevan concepts. But they will find the experiments as interesting although methodologically unsophisticated, as we have long since come to expect from Piaget and his co-workers. The results they will find intriguing. The present reviewer has replicated one of the experiments ; the results (published) agreeing with the Geneva data in many, but not in all, respects. However, here is another book (earlier published in French) from Piaget and his co-workers, which may be regarded as a source book of ideas and experiments permitting a fresh approach to an important area of educational psychology.

Battro's *Dictionary of Terms* contains many of the most important terms found in several thousand pages of the works of Piaget and his colleagues. For each term there is one or more passages taken from the writings of Piaget or a co-worker, in order to preserve what was actually said when the term was used. Further, at the end of each passage the reference is given to the book or article in which the passage is found For the advanced student this is a most useful volume. But it must be remembered that the Genevan system is a developing one. Terms used in later developments are not to be found, since the dictionary was compiled in the early 1960s. Again the term *scheme* is not included, while *schema* is not defined as Piaget now intends it to be in English. If such points are borne in mind the book will prove of great value to serious students of genetic psychology and genetic epistemology.

K. LOVELL.

REID, J. F. (Ed.) (1972). *Reading: Problems and Practices.* London: Ward Lock Educational, pp. 415, paper £1·30.

The present volume is intended to present an overview of problems and practices related to reading failure and its assessment. The book is divided into five sections. The first part deals with the definition and scope of the problem of reading failure. The second part describes the social, cultural and environmental correlates of reading failure. The third part is limited to the discussion of developmental aspects of reading difficulty. The fourth part explores the subject of diagnosis and treatment of reading failure, and the final part concentrates on prevention. Most of the papers collected in this book have been published elsewhere and on the whole the present selection appears to present a very balanced view on the subject of reading. The editor seems to go along with the view that different and sometimes opposing views can be collected and presented as one whole.

It has been now generally recognised that a handicap in reading is a crippling disorder in a society that is increasingly dependent upon literacy. One of the most important problems that may arise in connection with a reading failure is the problem of adjustment of the failing individual. Many people, as suggested in the foreword, are becoming conscious that those who cannot turn to books to fill part of their extra amount of spare time, will sometimes turn to pursuits which are not very desirable. However, in spite of all our efforts and ever increasing provisions to treat and prevent reading failure, there are still many functional illiterates in our society.

Reading achievement has a positive correlation with intellectual potential, as the editor suggests, but there are many intelligent children who fail to achieve a standard compatible with their intellect and age; whereas some children, on the other hand, who are considered to have low ability, may become quite proficient in mastering the reading skills. The wide variety of articles and differing viewpoints collected in this book also indicate that no method or technique can be taken as an absolute answer to the problem of reading failure, and most people who know what they are doing and have faith in their technique, do succeed in achieving desirable results

It is somewhat disturbing to note, however, that some workers tend to limit their approach to one jargon, like ' dyslexia,' and tend to turn a blind eye to other factors. Perhaps the best way to minimise the problem of reading failure would be to tackle the problem of poorly motivated and culturally deprived child within the family at pre-school age. Some children could be identified through observation in reception classes and should get more opportunities and help in infant schools, and most certainly we should have increased resources in primary schools to overcome reading failures. For some children it is essential that we ought to have continuing provision of support and remedial help in secondary schools so that by the time they leave secondary school they are literate. It needs a nation-wide co-ordinated major effort completely to wipe out the problem of reading failure.

Perhaps, with the exception of the first three and the last three articles, the selection of papers appears to present the problem as one whole. It might have been useful if there had been an introduction or survey of reading problems and if the definition and scope of the problem were a little more clearly defined. Perhaps in such a selection an editor might find it a useful exercise to give a brief summary of each article, giving also perhaps the reason for and relevance of the selection. It is unlikely that busy classroom teachers or overworked students, for whom the book is primarily intended, would find time to use this volume. It serves a useful purpose for those who may have missed reading some of the material appearing in various journals at different times

RASHEED S. AZAM.

RICHARDSON, E. (1973). *The Teacher, the School and the Task of Management.* London: Heinemann, pp. xvi+366, £5·00.

Miss Richardson's book *The Environment of Learning. Conflict and Understanding in the Secondary School* (Nelson, 1967) has recently been reissued, with amendments, in the Heinemann *Organisation in Schools* series (1973, £2·25). In it, affirming that " we cannot fully understand what it means to be a teacher without understanding, at the feeling level, what it means to be a member of a group engaged in a common task with a leader," Miss Richardson looks at inter-personal relationships in the secondary school class. Drawing widely on her experience as a teacher and as a teacher of teachers, she offers in an easily read book much of value and of current relevance to teachers who see the building of relationships as part of their work, and who for that part need some understanding of the problems of working and thinking together in groups, and of the emotional forces which operate in the group situation.

In her latest book Miss Richardson starts from the same background and scrutinises, but in much more thorough fashion, the staff of a secondary school, observing and commenting on its inter-group and its intra-group functioning, and on the inter-personal relationships which operate in relation to the execution of its task and the management of its task. The earlier book relied largely on recollection This one is based on research. Now a Research Fellow at the Bristol University School of Education, Miss Richardson spent three-and-a-half years as consultant to the headmaster and staff of Nailsea School, a secondary school about 10 miles from Bristol, serving an expanding dormitory town. The period was one of transition from a selective school to a comprehensive school, of curriculum innovation, of expansion from a roll of about 900 to one of about 1,250, and of corresponding increase in staff. (The school had opened 10 years before with a first-year intake of 89 and a starting staff of four.) The book is a very detailed case study, with commentary. It describes a real school, and real people, and communicates, at times engrossingly, the reality of the situation.

After identifying and surveying current conflicts and uncertainties in the secondary school, the author outlines her theoretical standpoint. She is primarily interested in human relationships and how they help or hinder the task of the group. "A committee is not just a cluster of roles : it is also inevitably a group of persons." Her study emphasises the contribution of group psychology and social psychology to an understanding of the functioning and behaviour of organisations, and the need for management to have knowledge of and have regard to the factors she sees at work. She is much influenced by thinking associated with the Tavistock Institute, by Rice's theory of the organisation as an open system exchanging material with its environment, the need for the management system to be consistent with the (in this case, educational) task, the need for the break-down of the primary task into sub-tasks with consequent sub-systems and boundary problems, the possibility of conflict between the task system and the sentient system ; and by Bion's theory of small group behaviour, and in particular his identification of the ' work ' group and the ' basic assumption ' group, and the latter's choice of dependence, fight-flight, or pairing (reproduction).

She discusses the nature of collaborative research and the role of the consultant. Throughout the book the reader is faced, as the writer was, with the dilemma of the participating observer—to what extent is she merely observing and recording, and to what extent, by her presence, her enquiring, her discussing, a major influence in the on-going process ? This reader is left in no doubt that Nailsea, as a result of the collaborative enterprise this book records, saw more clearly itself and its task, and the choices before it as it adapted its management structure and the role and personal relationships within it to meet changing situations. Other secondary schools (and perhaps other organisations) will find their problems mirrored and, even if not courageous enough to face a similar self-analysis, will, if top staff make the effort to identify the characters and follow the Nailsea story through, be more aware of the underlying factors and of possible solutions and necessary compromises.

The main part of the book is in three sections, each combining description of events, commentary and conclusion. A section deals with teachers in multiple roles, identifying the problems created by separate organisational structures for curricular responsibility and for pastoral responsibility, describing the transitional changes these structures went through, and tracing the evolution of a new management structure with an enlarged top management group. Heads of schools who have been or are going through similar experiences, but who have not the time, or the expert assistance, to permit the same kind of analytical reflection on the process and the reactions of people within it, should find encouragement, caution, insight, and constructive suggestion here.

Other pressures, leading in the same direction, take up the longest section of the book, dealing with the task of headship and the nature of consultation. " The real problem about the increasing size of schools is not just that there are more people around. It is that leadership must be dispersed more widely—that a greater number of the experienced people in the staff group must be given more power." Students of organisations should find scope for study in the careful observation and meticulous documentation of the personal reactions aroused, and the management problems created, by the increase in the number of leadership roles, by the change in their pattern, and by the attempt to move to a more participative system of management. The interpretation of the inter-personal behaviour in small groups, of inter-group relations in staff conferences, and of relations between the head and staff (individually and in groups) in terms of the author's theoretical standpoint is very plausible. Heads of schools, and other concerned with management structure, task definition, and the importance of role relationships in the effective implementation of management objectives, will observe the need to clarify and redefine the roles within the top management group, and the relationships of the members of that group with middle management

The story of Nailsea throws up the need for a school to nurture new talents and competences in the staff group as well as exploit existing ones. The book ends with a short section outlining new procedures for staff discussion and drawing attention to a growing awareness of the need for closer relationships with parents and governors.

This book is a well-written account of the management experience of one school and of its emergence from a period of turmoil. The situations are common to many schools, and the penetrating analysis should be of value to those interested in group psychology and to those concerned with the management of secondary schools. I hope that its length, and the careful reading its detail calls for, will not deter the practitioner

J. P. FORSYTH.

ROMEY, W. D. (1972). *Risk-Trust-Love: Learning in a Humane Environment.* London: Prentice-Hall, pp. 283, £2·00.

This book, with its evocative, if somewhat unwieldy, title, catalogues yet another step in the educational revolution which is slowly but irrevocably taking place in our schools and universities. All too familiar nowadays are the attacks on didactic, authoritarian teaching methods, and the promotion of various 'progressive' or child-centred approaches. What Mr. Romey advocates, in an American college setting, is an unstructured, non-directive, high-trust learning situation, where the student is allowed complete freedom of choice and action. This is not exactly a new thesis, as British universities have long been less rigid than American, although not as progressive as suggested here. What is novel, though, is Mr. Romey's conception of the whole student-teacher relationship, based on his personal educational experiences, both as a student and later as a geology teacher.

Firstly, while admitting there is little statistical evidence available, he believes much more valuable learning occurs in a democratic, 'humane' environment, where students freely choose which courses to follow, their subject matter, and manner of presentation—lectures, laboratory sessions, seminars, and field trips taking place, if and when required by the students. The teacher ceases to be purely an instructor and becomes a 'facilitator of learning,' aiming to provide as many opportunities for learning as possible. Conventional grades and examinations are abandoned, being damaging to the student's self image, and evaluation of work made by judgment of portfolios containing examples of students' best efforts.

Secondly, and most important, the teacher must abdicate his position of authority, and meet his students on their terms. Personal involvement with them will make him responsive to their needs as human beings as well as in education, and thus he will help them fulfill themselves as people, in a progress towards self-actualisation. In short, a teacher must take the risk of trusting his students and of providing an atmosphere of love for true education of the whole self.

Mr. Romey presents his case for 'Risk-Trust-Love' in a pleasant anecdotal style, although his chapter on personal educational reflections is perhaps overlong. The illustrations and frequent short subdivisions of the chapters cleverly add to the atmosphere of intimacy, echoing his essential educational point However, like many exponents of classroom freedom, details of practical issues are somewhat overlooked. The doubts of some facilitators are graphically described on pages 184-189, but merely given the global answer of love, trust and personal involvement as the solution.

This formula would seem more suited to the older student than the younger child, some of whom are unable to cope with a bewildering array of choices. While principally describing the university situation, Mr. Romey, through examples, shows he extends his ideas down to elementary and secondary schooling. Yet he offers no advice to the facilitator who has the physical problem of creating the required diversity of learning opportunities, or who has in his class a disruptive, dull, lazy or unco-operative child. The responsibility for learning rests with the pupil ,yet it has been found that in a free-choice situation some pupils become grasshoppers, skimming the surface of all subjects, others too single-minded and exclusive, while still others seem to need the security of a structured learning situation to make a happy adjustment. A policy of non-interference, therefore, can become inadvisable. In the reviewer's opinion, from observation of open-plan schooling in action, the freedom is not worthwhile if it is allowed to become licence, and some kind of disciplined approach and structure is necessary, certainly for younger pupils, whose goals are not yet formulated. Even at university level, some uniformity of courses and standards are necessary before degrees are awarded and certain information and skills are basic to all further knowledge. An engineer must have learned about metal stresses before he is allowed to a build a bridge and a child have achieved a minimum standard in the three Rs before the end of primary school.

Freedom is a valuable ideal in education but must be handled carefully. As to whether personal involvement is the secret of educational success there is no way of knowing other than by trying it, as Mr. Romey has—" . . . working at becoming a whole human being . . . is risky business . . . " (p. 283) but it is this aspect of his book that makes it for teachers, exciting, worthwhile and above all, challenging reading.

JOAN McQUOID.

SCHLESINGER, H. S., and MEADOW, K. P. (1972). *Sound and Sign: Childhood Deafness and Mental Health.* Berkeley: University of California Press, pp. xii+265, £4·50.

This book is likely to be of considerable interest to a relatively small range of readers. It is concerned with the so-called oralism-manualism controversy over methods of education for the hearing impaired child. The authors, a psychiatrist and a sociologist, respectively, have applied their particular professional knowledge and experience to this specialised and intricate problem.

They find that the main source of emotional stress for the parents of the deaf child, and hence for the deaf child himself, is still the question of whether or not to use the sign language as a means of communication. Part of the problem lies, in the authors' view, in the lack of mutual understanding between, on the one hand, those professional people responsible for the pre-school and school-age development of the child and, on the other hand, those responsible for the education, rehabilitation or treatment of the adolescent and adult.

Chapters 2 to 4 are by Schlesinger. After an insightful theoretical chapter written from an Eriksonian viewpoint, the author enters more controversial territory in chapter 3. Here she reviews, very briefly, five areas of literature relating to the use of manual communication in an attempt to explain why sign language has been held in disrepute. She concludes that under certain circumstances its use may be beneficial for deaf children. The following chapter, one of the most interesting in the book in spite of obvious limitations, reports a study of the language acquisition of four hearing impaired children all of whom were taught to communicate by a combination of sign language and spoken language.

The next three chapters are largely written by Meadow and are of variable quality. The first of these, which is of considerable interest, concerns a study of mother-child interaction in a group of 40 pre-school deaf children and 20 controls. The data illustrate the problems faced by such mothers and the ways in which they attempt to solve them within the constraints imposed by the handicap. The picture drawn of the 'didactic' mother is particularly striking and pinpoints vividly the effects of misunderstanding the oral approach.

Chapter 6 is much less satisfactory. Meadow reports a study of hearing impaired children who attend either day or residential schools and whose parents are either deaf or normally hearing. Because of considerable inadequacies in the treatment and presentation of the data, as well as problems inherent in the design of such research, the interpretation of the findings is impossible to evaluate. The conclusion drawn by Meadow is that the combined method results in greater academic achievement but this conclusion seems to the present writer by no means established by the evidence presented. Chapter 9 reports a fairly straightforward survey of the mental health of children in a residential school for the deaf.

The remaining three chapters are concerned prescriptively with mental health provisions for a deaf community. Oralists will find much to stimulate thought in this book but little to convert them to the combined method.

W. D. HINE.

SHIPMAN, M. D. (1973). *The Limitations of Social Research.* London : Longman, pp.xi+195, paper £1·20.

Most books on social research are written for students working for doctorates or other higher degrees, the remainder provide simplified accounts for a more general public of the statistical methods and research techniques employed by social scientists. Both kinds of books rarely have much to say about the limitations of social research or the haphazard and muddled way in which much of it is conducted. Dr. Shipman's book redresses this balance, and in so doing provides a useful text for those lecturers who wish to lead their students to some understanding of research techniques in the social sciences, and also to promote what Shipman describes as "informed scepticism instead of naive acceptance or rejection."

The form the book takes is somewhat unusual. Eight controversies which the social sciences allegedly illuminate are examined ; these examples are mainly taken from the field of education, an area of study Shipman knows well. The controversies furnish concrete examples for. Shipman's more general criticisms and comment amongst which they are interspersed.

His commentary has two major concerns : the first, the difficulty the social scientist has in matching up to the ideals of objectivity and neutrality. In considering this difficulty Shipman examines three main areas. One, the way in which the bias of the investigator leads him not only to select his evidence to prove his case but to be almost wilfully blind to any counter-evidence. Second, on the fact that given the exigencies of finance, time and space, most pieces of social research are rarely totally satisfactory in terms of research design and sampling. And thirdly, Shipman discusses the slipperiness and obdurateness of the human subjects which are the objects of the social scientist. Shipman reminds us once more that the social scientist disturbs sometimes subtly, too often crudely, the very situation he is claiming to observe with objectivity and neutrality.

Shipman's second major concern is with the practical uses of research. As he believes the social sciences are not able to provide decisive answers to crucial questions, the results of such research cannot have any direct value for social policy and other practical activities. Any claim that they do so is, therefore, false and may result in the position whereby " the social sciences are frequently used to justify existing fashion rather than as an objective basis for reform."

Perhaps one should not demand too much in the way of philosophical reflection from such a stimulating polemic, but Shipman does not make it clear whether he is accusing social scientists for their failure to match up to the natural sciences in the pursuit of objectivity and neutrality, or rather arguing that the model of the natural sciences is the wrong one for students of human behaviour to follow. If the latter, he fails to suggest a satisfactory alternative, except to argue that research should concentrate on investigating the gap between " the assumptions about real situations and reality itself "

B. SHAW.

SMITH, F. (Ed.) (1973). *Psycholinguistics and Reading.* New York: Holt Rinehart and Winston, pp. x+211, £2·50.

The ideas in this collection of papers are a refreshing change from arguments that seek to base methods of instruction in reading on linguistic analyses. Unfortunately the aims and scope of psycholinguistic research are often misunderstood, even by its practitioners, in that it is assumed that the rules of grammatical analysis and generation of sentences are incorporated in the processes of comprehending and speaking. The editor makes it clear in his preface and introductory chapter that such an assumption is unwarranted, and that his aim is to acquaint the reader with the possible contribution the unbiased study of psycholinguistics may make to understanding the processes of reading and learning to read.

To this end a paper by G. A. Miller outlines the origins of psycholinguistics in the full appreciation of the characteristics of natural language as outlined by the work of linguists, making it quite clear that such features are to be regarded as the outcome rather than the means of language production and comprehension. This sets the stage for various papers which explore the contributions of psycholinguistics to understanding the process of decoding from written language to meaning. The idea that a full grammatical and phonological analysis, with searches for grapheme-phoneme correspondences, is a prerequisite for comprehension is thoroughly challenged Instead the view is put forward that reading is essentially a process of sampling perceptual cues to check anticipated meaning. Deviations from the text are seen to be related to the skill of the reader. The beginner, with very little on which to base his guess, may be quite wildly out. The early reader, paying more attention to cue sampling, is likely to make errors like *saw* for *was* ; while the fluent reader, sampling more economically, may again be wildly mistaken, but within the bounds of what makes sense in the context of what has gone before. This sampling view is essentially a description of silent reading, but a congruent view of reading aloud is proposed, namely that articulation follows the identification of meaning, unless nothing more than 'word-calling' is achieved.

In spite of the orientation towards the reading process little is said, however, about actual learning. How the beginner attempts to make sense of print is not really explored. Perhaps this is not surprising, in that the study of psycholinguistics has not been able to make a significant contribution to knowledge about language learning as distinct from language use. One gains the impression that each learner must adopt his own strategies, but the point is not sufficiently made that writing is a social product. While some uniformity of approach on the grounds of particular linguistically-derived analytical processes might well be discounted, surely we might expect some similarity on grounds of socially agreed uses of writing, and on observation of the strategies displayed by readers ?

Two papers by Jane Torrey are of particular interest in that they describe the problems of children from sub-cultures speaking dialect forms of the language. In one paper she concludes that the differences between dialect and standard forms are not such as to deter the reader, and shows how some children learn to read with standard pronunciation while maintaining their dialect forms of speech. She is concerned that differences between learners and teachers in attitudes to speech, and in the use rather than the form of language, might be more effective handicaps. In her second paper she describes how a child from an impoverished background taught himself to read moderately well before starting school

These papers highlight the editor's second major aim, namely, to suggest strongly that instructional methods may be almost irrelevant in learning to read, except that there is a real danger of their coming between the learner and his skill A final paper by Goodman makes a definite plea to teachers to be wary of extravagant claims about the efficacy of materials or methods and, in particular, warns them to be critical of those purporting to be psycholinguistic. This epithet should be applied to the study of communication processes, not to the formulation of teaching methods.

In his final remarks the editor outlines the chief features of approaches to teaching reading that are likely to make the task harder rather than easier for the pupil He claims that if teaching reading is regarded as a problem, then this may well be due to a tendency to be over-concerned with rates of learning, and with teaching methods, at the expense of attempting actually to help children. The maxims of making reading easy and responding to what the child is trying to do are well worth pondering. Too often we only pay lip-service to the idea of child-centred education.

Although the papers presented stem from different sources, and are not all new, this book is well edited and can be recommended, either *in toto* or for dipping into, to all who are interested in teaching reading

HAZEL FRANCIS.

WATSON, P. (Ed.) (1973). *Psychology and Race*. Harmondsworth: Penguin Books, pp. 491, £0·90.

Peter Watson's collection of 23 papers may persuade many non-psychologists that a social psychological approach to the inflammatory problems of ' race relations' can be more practical than woolly polemics. The overall impression of the book is the *reasonableness* of the authors, but it is a pity that Watson chose not to include at least one paper by, e.g., Burt, Cattell, Eysenck or Jensen, or Coleman's excellent critique of the Eysenck–Jensen position (Coleman, 1973), to provide a little intellectual roughage in the somewhat bland diet of the book.

The book is divided into six sections : *Aspects of inter-racial interaction* (*a*) focus on the majority group, (*b*) focus on the minority group ; *Focus on the interaction* ; *The interaction of personality and culture* : *Education* ; *Language* ; and *A miscellany of other key issues*. About half of the book is concerned with prejudice and racial awareness, and another substantial section describes aspects of ' inter-racial ' situations ; however, the remaining sections, although headed (in part) ' key issues in social psychology,' lack cohesion and, in this reviewer's opinion, fail to clarify basic issues, although the papers themselves are of unquestionable quality.

The book might well have been better had it included more of Peter Watson's own writing, since one of the most interesting sections is his introduction, entitled ' Psychologists and Race · the ' Actor Factor." In this concise and imaginative section, the framework is sketched for the longer chapter that one would have been enthusiastic to read. Beginning with a reminder that a psychologist has ' a general world view ' and that his attitudes and beliefs, his relationships with other psychologists in his field " may determine the questions he asks in professional life and the methods he adopts to find and interpret the answers," Watson continues by relating salient aspects of the psychology of race to the positions adopted by various groups of psychologists at various times, and spends a tantalisingly few pages considering *why* there are advocates of a 'black psychology,' and of *what* it might consist. This theme (and its converse), could have provided a focus that the book seems to require but lacks.

Certain chapters stand out for their economy and clarity · Nevitt Sanford deals lucidly with the emotional dynamics of prejudice, and Henri Tajfel with the cognitive aspects: Proshansky and Newton show that minority status defines and limits the individual's senses of identity, and this theme is picked up by Ari Kiev in his study of psychiatric disorders in minority groups. Methodologically one of the most useful and tough-minded chapters is Sidney's Irvine's, "Tests as inadvertent sources of discrimination in personnel decisions," which with a rare, commendable coolness, criticises the lack of sophistication of the designers and administrators of psychological tests, who tend too readily to minimise the influence of culture and membership of a minority group upon test performance

Peter Watson's book is timely, though it would have added to its value had it attempted to make clear *why* this recent rise of a topic long thought dead has taken place. It is, perhaps, time for Peter Watson now to write his own book, in which he can take for granted the negative aspects of race, and can expatiate on the theme that the psychologist's interest in individual differences, and acceptance of these differences, should now be applied to 'races' or other groups where differences can be found to exist. His book shows that group differences are too frequently coupled with pejorative adjectives, and policies are based upon this. It is time for psychology to teach the layman that differences are—or may be—interesting, enriching to the total sum of human diversity, and quite without rational cause for alarm.

LEONARD BLOOM.

COLEMAN, A. M. (1973). 'Scientific' racism and the evidence on the race and intelligence. *Race*, XIV, 2, 137-153.

WESTMAN, J. C. (Ed.) (1973). *Individual Differences in Children.* New York: John Wiley and Sons, pp. xiii+345, £8·00.

" The subject of individual differences in children is both vast and diverse." How else could the book begin ? As it happens though, the coverage is not 'vast and diverse,' and the editor's aim appears to have been much less ambitious. Westman argues that whilst a great deal is known about individual differences in intellectual and learning capacities, relatively little is known about differences in temperament and personality processes. It is to the problem of individual differences in personality, therefore, that the book is primarily addressed. Five sections cover biological foundations, developmental perspectives, situational perspectives, research models and clinical applications.

A historical review of individual difference research counts as the first chapter, and this is followed by an account of recent work on 'instinctive' aspects of early sensory and perceptual processes. Individual differences scarcely figure in these findings. The third chapter focuses on sex differences in children up to age three. Two contributions in the developmental perspectives section take differences at birth and attempt to trace out their implications for behaviour in later life. They emphasise the point, being increasingly made in developmental research, that the infant is a major contributor in mother-infant dyads Other chapters in this section, on cognitive and physical development, are not well integrated with the book's primary theme.

From this point onwards the weakness of the book begins to show. There is no shortage of ideas, and contributors like Wolff, Chess, Tanner, Escalona and Harlow are known to most developmental psychologists. The real problem is the dearth of empirical findings on which valid generalisations can be based. A revealing quotation comes from Escalona's chapter in the situational perspectives section. " When it comes to the more complex individual variations in such things as basic attitude, cognitive style, the quality of interpersonal relationships, the organisation and content of affective life, novelists are far ahead of psychologists in tracing the origin of these characteristics " (p 151). As if recognising this, the longest chapter in the book is a case study of the integration into nursery school of two girls with contrasting personalities. Birth order and cognitive style are discussed in the last chapter of the section

Three approaches to data collection, embracing behavioural, psychoanalytic and animal techniques, provide suggestions for analysis of individual differences in the section on research models. An obvious opportunity to discuss the role of psychogenetics in data collection was missed here. The final section summarises difficulties in applying useful models and making shorthand, inexpensive diagnoses in clinical practice. As a source of information for the benefit—so the publisher says—of child psychiatrists, paediatricians, nurses, social workers, educators, counsellors and parents, the book is bound to be disappointing. It might be of marginal interest to scholars, if only to remind them how scarce hard facts are on individual differences in children

JOHN WILCOCK.

WILSON, J. (1973). *The Assessment of Morality*. Slough : NFER, pp. x+115, £2·00.

The Assessment of Morality is divided into two sections, plus three short appendices. The first section is concerned with definitions and problems and the second section more properly with assessment. The book is intended for research workers in psychology and the social sciences (though not restricted to these), and is primarily meant to clarify the conceptual difficulties which, the author holds, are at least as important as the purely empirical problems besetting the development of adequate methods of assessing morality.

The basic problem is to decide what is to count as moral. This is not purely a matter of definition, but a matter of being clear about what concepts we want and need, and how these are related to what people may mean when in everyday life they use the terms ' moral,' ' morality ' and other related terms. Further, one should be clear about the difference between including ' a ' in the definition of ' x ' and stating that ' a ' and ' x,' assessed independently, are empirically related as a matter *of fact*. As one example, the author takes Aronfreed's definition of ' altruism ' as involving ' empathy.' Are we clear about whether we are saying that *only* when there is empathy can we talk of altruism, or whether we are maintaining that *in fact* altruism depends upon empathy? Wilson's point is that much research in psychology, particularly in the field of moral development, has been bedevilled by lack of conceptual clarity and that productive research on morality is virtually impossible until some degree of conceptual clarity has been reached. The author makes many similar points, for example, the difficulty involved in the implicit assumption that morality must have a specific *content*, and the limitations of research based on such an assumption.

John Wilson emphasises that with human beings we must be concerned with such subjective things as intentions and so on. " Research into human thought and action, whether in morality or other fields, involves a whole new dimension : a dimension in which reasons, language, intuitions, descriptions and all the apparatus of rationality is of paramount importance." We cannot really understand or explain a human being's actions without knowing or at least surmising what rules he was himself following or trying to follow.

With regard to cognitive, affective and behavioural aspects of morality, the author believes that we tend to make the distinctions between these in too naive a way, that this is misleading and that we need to take account of all aspects in assessing moral commitment, without which studies of moral judgment, for example, must be relatively superficial

The second part of the book gives an account of the author's own scheme for assessment of 'moral components,' directed at bridging the gap between what is normally meant by moral thought and action, and practical assessment of these. Those who are familiar with previous work by Wilson will be familiar with his 'components,' but those who are not can still understand perfectly well what is involved.

The present book is not long, but is both illuminating and stimulating. Not all who read it will agree with the author in all he says, but it should certainly be regarded as required reading for anyone interested in the field, and more particularly for anyone contemplating research.

D. GRAHAM.

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EDITING THE JOURNAL

By J. D. NISBET

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I WAS appointed editor in the summer of 1967, and I retire when the copy for the last issue of 1974 has gone to the printer. What has it been like to do this job?

The interesting part of the job is the variety of contacts with research workers throughout the world. The 1,000 papers submitted during my period of office came from 40 different countries. 630 of these were from Britain, 110 from USA, 70 from Canada, 53 from Australia, 32 from African countries, 30 from India and Pakistan, 21 from New Zealand, 18 from Middle East countries, 18 from Western Europe, 12 from the Pacific and South East Asia, 4 from Eastern Europe, 1 from West Indies and 1 from South America. The subscribers to the *Journal* are as widely distributed as the contributors, extending over 80 countries from China to Peru. The *Journal* has a circulation of close on 4,000: about half of the subscribers are in Britain, about 500 in USA, and some 250 in Australia. Also represented in our subscription list are Japan, Canada, New Zealand, India, Pakistan, Ceylon, 24 other European countries, 14 other Far East countries, USSR, 12 African countries, 9 Middle East countries and 10 countries in Central and South America. Since many of the subscriptions are from libraries, the readership is considerably greater than the circulation. Scientific journals have been described as an 'invisible college', with a network of communication which recognises no national boundaries. In recent years some research workers have tended to favour publishing their results in book form, and it has not been too difficult to find a publisher. But if a researcher wants to put his findings into circulation in the academic community, there is no more effective way than to publish in a journal. Publication in this *Journal* provides an international circulation on a much larger scale than any book and, through libraries and abstracting agencies which screen every issue routinely, it secures for a piece of work a lasting position in the annals of research.

If the editor's first impression is a sense of privilege in being at the centre of this network, the second point to mention is the volume of work which comes his way. Over the years, the number of papers submitted and accepted for publication, and of books received and reviewed, is as set out in Table 1.

TABLE 1

PAPERS SUBMITTED AND PUBLISHED, AND BOOKS REVIEWED, BY YEARS.

Year (to 31st May)	1968	1969	1970	1971	1972	1973
Papers submitted	124	119	153	163	133	140
Papers published	33	31	36	39	30	39
Theses abstracts	7	11	10	4	(discontinued)	
Acceptance rate (%)	32	35	30	26	22	28
Books received	210	196	197	198	312	244
Reviews published	42	53	49	55	55	60

Adding in the period since May, 1973, gives a total for the seven years of a little over 1,000 papers and about 1,500 books. Perhaps this does not seem too much of a burden, until one realises that it amounts to one new paper every third day for seven unrelenting years. The flow is spread unevenly over the months. For example, the monthly distribution of papers received in 1972, is shown in Table 2. August and September are the cruellest months, for not only is August one of the peak months for submissions, but this is the time when we are checking proofs for the November issue, preparing copy for the February issue and reviewing papers for the following June issue. Busiest of all was one month in the spring of 1971, at the end of the postal strike, when in 30 days, no fewer than 40 papers were received.

TABLE 2

NUMBER OF PAPERS SUBMITTED IN 1972, BY MONTHS.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
11	12	19	10	9	13	13	17	6	10	12	8

In all except a few cases, a decision on publication is given to authors within six weeks of receipt of a paper. This has been possible only because of the invaluable aid of referees, and the untiring assistance of my colleagues, Ralph Dutch (who, with the editor, has read every paper submitted and as review editor has screened all the books for review) and the sub-editor, Shirley Cunningham. The sub-editor prepares manuscripts for the printer—and almost every one contains some technical defect of omission or error ; she also proofreads galleys for authors overseas, checks corrected proofs from authors, and reads the complete page-proofs—thus reading every paper in close detail three times over.

In one respect the *Journal* is unique among psychology journals : in seven years, every issue has appeared on time. Much of the credit for this must go to the printers, Birmingham Printers, Ltd., who have printed the *Journal* since its first issue in 1931. Only those who have experienced the problems which can arise in printing will appreciate how much the *Journal* owes to the support given by the staff of Birmingham Printers, Ltd.

The average interval between receipt of a paper and publication has been nine months, and this includes, for at least half of the papers, some discussion with authors on appropriate revision. It also includes the initial reading by both editor and assistant editor and by referees ; preparation by the sub-editor for printing ; setting in print ; preparation of galley proofs ; checking of these by authors ; setting in page proof ; checking page proofs ; printing ; binding ; and distribution. Copy is sent to the printer four or five months before the publication date, and since there are only three issues a year, an average publication lag of nine months is close to the irreducible minimum.

Less than one in three of the papers submitted has been accepted for publication. When a paper is not accepted, the editor has always tried to summarise, in a personal letter to the author, the main reasons for rejection. About one in 30 of the authors of rejected papers write in reply, usually rejecting the comments made and sometimes alleging incompetence of referees and editor. Slightly more frequent are letters from authors (especially those whose papers are eventually published after suggested amendment) expressing appreciation.

I do not recall ever rejecting a paper merely because it was badly written: sometimes, it has been possible to persuade a referee or someone else to make detailed suggestions for amendment. It is difficult to strike a balance between editorial intervention and unwarranted interference. It is also difficult to find anyone willing to do reconstruction work on someone else's paper. Yet I think that there are cases when worthwhile findings can be rescued, or at least made more intelligible, in this way; and at the risk of unpopularity with authors, we have not hesitated to ask for modifications and clarification. Reasons for rejection were summarised in the editor's 1969 report to his board, and the points made then apply to all years, with changes of fashion affecting the particular topics over-represented in the submissions for any one year.

"As in 1968, most of the papers returned to authors were based on small or unrepresentative samples, or reported only the preliminary stages of an inquiry. Three types of paper in particular were commonly offered but were not accepted: factor analyses of inter-correlations where tests had not been selected according to any systematic design and results were essentially a list of the author's interpretation of his factors (availability of inventories like 16 PF and of computers mainly to blame); Piaget-type studies on conservation, on very small samples and using tests made up by the author so that results were not comparable with other studies; questionnaires given to university students (without pilot studies) and answers set against examination performance, where most of the results were not statistically significant and those that were could hardly be described as educationally significant."

The number of pages in the *Journal* is limited (by cost) to about 340 per year. The actual numbers in each volume since 1968 are: 341, 343, 369, 362, 345 and 330. The commonest sin among authors (from an editor's viewpoint) is the urge to write too much, to include too much detail (" in case any reader should happen to need it ") and to report all the aspects of their studies without identifying one or two main themes as the central structure for their material.

The *Journal* is an independent company, and it must pay its own way. (One achievement to be claimed is that it is now financially secure.) The *Journal* is, in fact, a business, with a turnover of between £12,000 and £13,000 a year; and the editor is the chairman of the board of directors. No payment of any kind is made to the editor or his editorial colleagues, or to any of the directors. Our publishers, Scottish Academic Press, take care of the business and financial aspects. This includes distributing the *Journal*, collecting subscriptions (and issuing reminders), maintaining an up-to-date address list of subscribers, managing the advertisements section of the *Journal*, looking after the accounts and official returns, negotiating reprint agreements on behalf of authors and a variety of other activities. Douglas Grant, managing director of Scottish Academic Press, is the secretary of the British Journal of Educational Psychology, Ltd.

The first editor, C. W. Valentine, whose period of office extended from 1931 to 1956, ran the *Journal* from his own study, virtually single-handed. This style of editorship continued with his successors, P. E. Vernon and L. B. Birch: without it, the *Journal* could not have survived at the price which was charged. In my first four years, the average annual cost of the editor's secretarial assistance was £73 per year. Already we have begun to move towards a more professional style of management, and the need for such a move is clearly evident. Yet I hope that, as the *Journal* develops, subsequent editors will still be able to preserve the personal contact with contributors, which has been for me the most rewarding aspect of the job.

CONTEXT IN READING AND LISTENING: A COMPARISON OF CHILDREN'S ERRORS IN CLOZE TESTS

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SUMMARY. Sixty-six children aged 9–10 years were tested in two groups with two parallel cloze tests of reading comprehension. The same tests were then given as cloze tests of listening comprehension. Each group received different parallel forms in each of the language modes. The scores for the listening tests for both groups were significantly lower than the reading scores.

Significantly fewer responses were made in the listening mode. Analysis of errors made in both modes revealed that 44 per cent of errors in the reading tests and 37 per cent of errors in the listening tests were syntactically appropriate responses.

INTRODUCTION

ERRORS made in reading have been the subject of study for a considerable time. In the early tachistoscopic experiments reviewed by Huey (1908) errors were deliberately introduced within the words displayed and inferences made about reading processes from the subject's report of what he saw. Since then attempts have been made, in a number of ways, to infer from errors made in oral reading, the causes of those errors. The literature is summarised by Weber (1968) and it is only necessary here to draw attention to some recent issues and emphases.

Although certain writers still consider that research activity should be directed at the word level (Shankweiler and Liberman, 1972) the general tendency has been to look beyond the word to its context for cues which cause misreadings. Studies of the errors made by children reading continuous prose have drawn attention to the grammatical constraint operating within sentences; it has usually been found that preceding linguistic structure affects the kind of error made (Goodman, 1967; Biemiller, 1970; Weber, 1970). There is some doubt, however, that all children can use contextual restraints in reading; Francis (1972) found that lack of ability to span several words, and a functional rather than a formal use of language structures, militated against the use of context in initial reading.

Rather little attention has been paid to constraints working across sentences, although a study by Ramanauskas (1972) strongly suggests that such constraints do operate. There is some debate as to how far removed constraints may be in order to affect responses. MacGinitie (1961), for instance, found that cues more than five words away are rarely used, yet other writers (Carroll, Carton and Wilds, 1959) found that remote constraints can affect responses.

Studies have also been made of the effect of different sentence structures on reading, and it would seem (Gibson, 1972) that it is possible to identify types of sentence structure which give rise to varying degrees of difficulty in reading. Yet, as Gibson stresses, how precisely the reader develops his knowledge of structures so that it becomes incorporated in his reading habits remains a mystery.

Since it is generally agreed that grammatical constraints do affect reading performance, attempts have been made to teach the use of knowledge of structure. Gibson (1972) argues that the use of structural information cannot be taught, on the grounds that perceptual learning is involved and reinforcement must be internal and self-regulated. Nevertheless, it is accepted that children should be encouraged to use context as an aid to word recognition in initial reading (Clay, 1972) as well as in the development of what have been called the ' intermediate skills ' (Merritt, 1970). Justifications for such a view include the child's able use of context in listening before he begins to read (Langman, 1960) and the similarities which are assumed to exist between use of context in listening and reading (Gates, 1962).

A positive relationship is generally found between the receptive language skills of reading and listening (Reddin, 1969) and it has often been suggested that reading skills can be developed by improving listening skills (Bracken, 1972).

Kennedy and Weener (1973) investigated a means of improving performance in these two language modes with third-grade children. They found that subjects improved in both reading and listening and that there was transfer of the improvement from reading to listening ; however, transfer in the reverse direction was not so well established.

This investigation is particularly relevant to the present study, since cloze procedures were used for the skill training. Cloze technique involves the deletion of those words occurring at certain predetermined intervals in a message. Most commonly every fifth, seventh or tenth word is deleted. The text or message is then administered to readers or listeners who attempt to supply the deleted words and make the message complete again (Taylor, 1953). Although deletions are usually linguistically random, another approach is to select certain pre-determined linguistic items for deletion (Goodacre, 1971).

The results of Kennedy and Weener give rise to some questions about the similarity of reading and listening and, in particular, the use of context by the reader and the listener when using the cloze procedure.

An assumption commonly made concerning the use of context is that a person often anticipates in reading just as he does in listening (Goodman, 1967). Guesses at an unknown word or blank in a text then tend to be regarded as highly influenced by predictions already made from preceding textual information (Merritt, 1970). But Burns (1967), referring to Weaver, suggests that the words following a strange word may be better aids in guessing from context.

It seems likely that cues which a child uses in cloze procedure will depend upon at least three interrelated factors : his mode of reading (i.e., whether he is reading orally or silently) ; his proficiency in silent reading ; and the set he adopts (i.e., whether he feels it permissible to look ahead). It has been argued (Pugh, 1974 ; Morris, 1963) that true silent reading involves non-sequential processes which differentiate it from reading modelled on oral reading. In contrast, in listening, information is received sequentially and the listener usually has no control of the message for forward and backward scanning. This difference in the two language modes may affect the cues available to the child. Possibly, then, the information and strategies which are available to the child when he uses context to help him provide words omitted in a cloze test, will not be the same when reading silently and when listening.

This problem was investigated in the present study, where the purpose was to compare children's performance on similar cloze tests of reading and listening with regard to incidence and type of errors.

SUBJECTS

The sample comprised all children (N=66) aged between 8 years 10 months and 10 years 9 months attending a Roman Catholic primary school in Yorkshire. Most of the children were from working class or lower middle class homes. The sample consisted of 40 girls and 26 boys.

Subjects were allocated randomly to two groups so that, in each group, the numbers from each school class were equivalent. Group X contained 32 subjects and group Y, 34 subjects.

PROCEDURE

Materials.

The GAP test of silent reading comprehension (McLeod and Unwin, 1970) was administered. This is a cloze type test in which approximately every tenth word (linguistically random) is deleted. Two parallel forms (R and B) are available. Although of Australian origin, it has been standardised in the United Kingdom and is of known reliability and validity.

The test was modified so that it could also be used as a test of listening. For this purpose both forms of the test were recorded by a female adult reader. Initially, the recording was done with the gaps filled in by the reader, the intention being to mechanically delete the inserted word. By this means the intonation patterns would have remained normal but it was found impossible to satisfactorily delete certain words owing to their elision with other words in the text. Finally, it was decided to read the passages in such a way that a hiatus of minimal length occurred whenever a ' gap ' occurred in the test. The passages were then re-recorded so that the length of the hiatus was increased to a constant 10 seconds.

For each of the parallel forms (R and B) of the GAP test an answer paper was prepared with numbered lines relating to the ' gaps ' in the recorded cloze test passage.

Testing.

The two groups were tested simultaneously by two experienced experimenters, each with an assistant. Group X was first tested with the Form R of the GAP reading test, while group Y was tested with the Form B. The test manual instructions were followed.

After a short rest group X received the Form B of the GAP test, but now used as a test of listening. Group Y accordingly heard Form R.

Practice examples were given for both reading and listening, but these were given twice for the listening test owing to its novelty. Subjects then heard a tape recording of the appropriate form of the test and whenever a ' gap ' occurred they wrote their response on their answer sheet. As with the reading test it was stressed that subjects should try their best to respond but that they could, of course, leave a blank on their answer sheet.

Scoring.

The test papers were scored according to the manual which follows the procedure laid down by Taylor (1953) in not allowing synonyms. Consideration was given to the possibility of allowing points for words in the correct semantic field but this was rejected because of the subjectivity involved.

Errors were classed in three categories. Firstly there were omissions, secondly there were responses which were wholly inappropriate, and thirdly there were responses which were incorrect according to the manual but, in their context, were to some extent linguistically appropriate.

These partly appropriate responses were judged in two respects, the syntactic and the semantic. A syntactically appropriate word was a part of speech acceptable for the gap in the test passage. A semantically appropriate word had the identical stem to the correct word. Words could be both semantically and syntactically appropriate yet still be classed as errors where the form was not appropriate morphologically, that is with respect to tense, person, case, or number. Those responses which were syntactically appropriate could also be appropriate morphologically.

Other data available.

One month before the investigation the whole sample had been tested in school with NFER Reading Test AD (Watts, 1970). Formerly described as Sentence Reading Test 1, this test is of the multiple-choice sentence completion type, the word required always being at the end of the sentence. The results of this test were available to the experimenters.

RESULTS

The means and standard deviations for both the GAP Reading and the GAP Listening tests for the groups X and Y and for the scores of these groups combined (total sample) are given in Table 1. Since each subject had taken both reading and listening tests, the two means for the total sample were compared by a t test for related samples (t=5·93, P<·001).

The lower listening mean of the whole sample is equivalent to a reading age of 8 years 9 months on the GAP test norms; the higher reading mean for the whole sample gives a reading age of 10 years 7 months, compared to the mean chronological age of 9 years 8 months.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF GAP TESTS FOR TOTAL SAMPLE AND FOR GROUPS.

GAP Tests	Group X	Group Y	Total
Reading	(Form R)	(Form B)	
Mean	25·38	23·88	24·60
SD	4·99	5·26	5·22
Listening	(Form B)	(Form R)	
Mean	17·81	10·18	13·87
SD	4·39	3·53	5·53
N	32	34	66

In order to discover whether the randomly chosen groups X and Y were in fact similar, the means of the two groups were compared for the NFER Reading Test AD and the Reading and Listening GAP Tests by t tests for independent samples. These tests gave only one significant result; for the Listening GAP Test, t=7·74 (P<·001). There was thus no significant difference between the groups in their performance on either of the standardised reading tests. However, for the listening test, Group Y, which listened to Form R, obtained a significantly lower mean than group X, which listened to Form B (see Table 1).

To determine the relationship between scores on the three tests for the whole sample, Pearson product-moment correlation coefficients were calculated. These are given in Table 2.

TABLE 2

RELATIONSHIPS BETWEEN TEST SCORES FOR THE WHOLE SAMPLE.

Tests	r	P
Reading Test AD—GAP Reading	0·80	$<\cdot 01$
Reading Test AD—GAP Listening ...	0·50	$<\cdot 01$
GAP Reading—GAP Listening	0·48	$<\cdot 01$

The correlation between the two reading tests is high, while a significant relationship is found to exist between the reading tests and the test of listening.

The method of analysing errors on the GAP tests has already been described. The frequencies and percentages of the various errors on forms B and R in both reading and listening modes are given in Table 3. Chi squares were calculated to permit the comparison of the incidence of different types of error made in the two forms, B and R, of the GAP test in both the listening and reading modes. For this purpose omissions were ignored. When the B and R forms of the reading test were compared there were no significant differences between observed and expected frequencies of types of error ($\chi^2=1\cdot 99$, df=4). The incidence of types of error in responses to the two reading tests was similar (as were the means of correct responses, see Table 1).

However, when the errors made in the two listening tests (B and R) were considered, a significant difference between error pattern was discovered ($\chi^2=24\cdot 43$, df=4, $P<\cdot 001$). Examination of the cell frequencies showed that for Form B the observed frequencies of errors which were wholly inappropriate and those which were appropriate syntactically only were lower than the expected frequencies.

A comparison of the B forms of the test showed no significant difference between types of error made when the rest was used in the reading mode compared to the listening mode ($\chi^2=6\cdot 64$). Thus Form B could be regarded as acting similarly whether used in the reading or the listening mode, with regard to type of error, though not, of course, with regard to mean score of correct responses (see Table 1).

A significant difference was, however, found in the comparison of types of error in the R form of the tests when used in the listening and reading modes. A χ^2 of 9·62 ($P<\cdot 05$) was calculated and, on examination, the frequency of the observed syntactically appropriate errors was lower than their expected frequency for the reading mode.

Thus, the frequency of some types of error in the R form of the listening test was significantly higher than expected when compared either with Form B of the listening test or with the same Form R used for reading.

TABLE 3

FREQUENCIES OF TYPES OF ERROR IN FORMS B AND R OF THE GAP TESTS.
(Percentages in parentheses)

Test and Form	Omissions	Wholly inappropriate	Incorrect but appropriate				Total
			Syntactically	Syntactically and morphologically	Semantically	Syntactically and Semantically	
Reading: R	21 (4)	270 (51)	34 (6)	169 (32)	—	34 (7)	528
Reading: B	58 (9)	259 (43)	34 (6)	195 (32)	32 (5)	32 (5)	610
Listening: R ...	186 (17)	514 (47)	72 (7)	280 (26)	—	31 (3)	1083
Listening: B ...	204 (27)	249 (33)	43 (6)	214 (28)	20 (3)	22 (3)	752

The very high frequency of omissions in both forms of the listening test, relative to the reading test, will be noted from Table 3. The frequencies of omission errors and total remaining errors were thus compared by a 2×2 table for the two forms of the test in both the reading and listening mode. A significant difference in number of omissions between the two modes of Form R was discovered ($\chi^2 = 57{\cdot}31$, $P < {\cdot}001$) and also between Form B in the two modes ($\chi^2 = 60{\cdot}4$, $P < {\cdot}001$). It was found also that when the two Forms B and R of the reading test were compared there was again a highly significant difference between the tests with regard to omissions and total remaining errors ($\chi^2 = 15{\cdot}9$, $P < {\cdot}001$). Similarly, when the two forms used in the listening tests were compared, a significant difference between the forms was found in respect of omissions and remaining errors ($\chi^2 = 26{\cdot}27$, $P < {\cdot}001$). In each comparison of the two forms, in either reading or listening mode, Form B is seen to have higher frequencies of omissions than Form R.

DISCUSSION

It is clear that when the children listened they found more difficulty than when they read, in successfully completing the cloze test. In particular, when a test blank occurred near the beginning of a sentence they could not anticipate the word and this is reflected in the large numbers of omissions or errors totally inappropriate to the text. However, generally when children had sufficient preceding information in listening and in reading, they did try to choose words for the blanks which were syntactically, and to a lesser extent, semantically appropriate.

The fact that, when they could, the children used contextual cues in their choice of word in both listening and reading tests is shown by the error analyses in Form B of the reading and listening tests. Here, if omissions were ignored, the incidence of type of error was very similar. This was not so for Form R, and here the fact that there were many more blanks right at the beginning of sentences in this test, compared to Form B, must be noted. It appears that because certain cloze tests are equivalent measures of reading comprehension, they are not necessarily equivalent tests of listening comprehension.

In the present investigation, the reason for this seems to be that in the reading test the children were able, not only to anticipate, but also to adopt a non-sequential approach and use subsequent reading information to help them fill an earlier blank. In the listening test, without this opportunity, the child was entirely dependent on the preceding information.

The high relationship between the two reading tests is interesting because the NFER test consists of a number of sentence completion tasks. Here full information is available before the appropriate word is to be chosen ; moreover, the five words from which the child must choose are usually all the same part of speech and with morphology appropriate to the sentence. A comparison of such a test in reading and listening modes might thus show fewer differences than the present comparison using cloze tests. Here the different nature of the reading and listening tasks is reflected in the quite moderate relationship shown between the listening tests and each of the reading tests.

Two general points arise from the present investigation. First, the beginner in reading may, as Francis (1972) suggests, have some difficulty in using context when he reads a new text, particularly when unknown words come at, or near, the beginning of a sentence. If the child has written the text himself, or if it has been discussed or read aloud to him (Clay, 1972 ; Morris, 1972 ; Neville, 1968), the situation is closer to that of the moderately fluent reader who is able to scan ahead. A beginner cannot do this (although the teacher ' hearing ' him read will certainly have done so) and is normally helped only by what he has already deciphered, some modest phonic knowledge and, possibly, by a picture.

Second, because of these difficulties there is probably a minimum reading age below which cloze reading tasks with random deletion cease to be useful. At the same time, the protracted use of cloze procedures for training in comprehension in either listening or reading should, perhaps, be examined further. The need to scan ahead and then regress to fill in blanks could possibly inhibit the efforts of the child visually and mentally to organise the text as he reads. In listening, also, the blanks destroy the organisation of the message provided by the intonation of the speaker. In his review of the cloze procedure as a teaching technique, Jongsma (1971) concludes that, on the research evidence available, there is some doubt as to the effectiveness of the cloze procedure as a teaching technique.

The present study was only exploratory. Further work is required in more closely comparable reading and listening test situations. We hope also to provide more detailed analyses of the types of errors in the listening and reading tests which may help to clarify further how children, as they listen and read, ' use the context.'

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TEACHERS' RATINGS OF CLASSROOM BEHAVIOUR: FACTORIAL STRUCTURE

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SUMMARY. A five-factor structure in ratings by teachers is proposed as useful and theoretically justifiable, comprising stable and unstable aspects of extraversion-introversion, and a dimension of Competence or the Good Pupil. The construction of a scale to test this structure is described. The resultant factor analysis supports the five-factor structure at the first-order level, and at the second-order level there is a parallel with broad dimensions identified by other workers.

INTRODUCTION

THIS article will present some research results relevant to the question of how many factors may usefully be identified in teachers' ratings of classroom behaviour in primary schools. The criterion of usefulness is that a factor should be at least moderately independent and should be represented by a sufficient number of items to form a viable subscale.

Important contributors of evidence on the factorial structure of ratings have been Cattell and his co-workers (Coan, 1966) and, in this country, Hallworth (1966 and references). Cattell and his associates identify about a dozen of the 'source traits' of personality found by them in other media, and Hallworth, who uses fewer items and extracts fewer factors, links the two largest dimensions in his analyses with the extraversion-introversion and neuroticism types of Eysenck's (1953) system, which have analogies with the work of Burt (1965 and references), and the second-order factors of Cattell (1957). Hallworth also showed that these major dimensions were loaded by items derived from Osgood's semantic scales (Osgood, 1962; Osgood *et al.*, 1957): the neuroticism, 'stability' or 'Good Pupil' items were joined by Osgood's 'Evaluation' (good-bad) type, and the extraversion items were correlated with the 'Potency' or 'Activity' dimensions.

As a result of these studies, we can be fairly sure that two broad dimensions will emerge in almost any personality rating medium. Cattell's work indicates that many more factors could be extracted from a suitably large item pool. The question remains whether such a multiplicity of scales is useful according to the limited criterion set out at the beginning of this paper: Peterson (1965) has questioned the identifiability and reliability of such narrow factors, preferring in this respect a two-factor system.

The two-factor scheme seems important for its link with Eysenck's and Hallworth's theories. In the sphere of maladjustment (e.g., Quay and Quay, 1965; Rutter, 1967), the two major dimensions appear to be Eysenck's E and N rotated through 45°, thus making subscales which identify unstable introverts and unstable extraverts. However, although a two-factor system may be a basic foundation, the item groups thus formed do seem rather gross, and it may be that a useful scheme can be created with more than two factors but less than the multiplicity of narrow and often overlapping clusters which appear in the Cattell work.

One possible addition to the two-factor framework may be a cluster of items describing high motivation, self-organisation, and reliability in school. It would seem entirely reasonable that such a cluster should emerge in teachers' ratings, and a search of the literature supports this. In Cattell's (1963) study, there was a group of items identified by him as corresponding to the B (' Intelligence ') factor in questionnaire data. This factor comprises such items as speed of learning, attentiveness, and alertness. It is correlated ·63 with a dimension identified as G (' Superego Strength ') and including such traits as tidiness, responsibility and social polish. These two factors between them would seem to constitute a possible group, to which the writer would give the name Competence.

Further illustration of a possible Competence cluster comes in some of the analyses of ratings on the Peterson Problem Checklist (Peterson, 1961). Using this scale, Quay *et al.* (1966) factor analysed ratings on 441 disturbed children. They found the usual factors of Conduct Problems (extraverted instability) and Personality Problems (introverted instability). In addition, they found a third factor, named Immaturity, characterised by such items as laziness, lack of interest, sluggishness, pre-occupation, drowsiness, dislike of school, and inattention ; this seems a Competence dimension with an added pathological flavour.

The study of Ross *et al.* (1965) also had a third, possibly Competence, factor emerging in addition to the two common groups. They name it ' Prosocial ' : it includes items describing the child as interested in school work, able to concentrate, alert, popular, self-confident, etc.

Hallworth (1966) reports a small factor of Emotional Stability independent of the larger Good Pupil or Evaluation cluster with which Stability usually cohered in his earlier work. He interprets this as evidence that, given more items than he used, it would be possible to separate off a Stability factor from the Good Pupil items (reliability, concentration, etc.). The latter would then become more akin to a straight Competence cluster.

The evidence so far reviewed indicates that a Competence dimension is a possible result from item pools yielding the two usual factors of E and N or their ' problem ' versions. It is not clear to what extent this factor is independent of the other two but, whatever the relationship between Competence and other groups of behaviour, it would seem important to separate it from them. The writer feels that some scales of ' maladjustment ' or ' conduct ' have an unidentified Competence element (Herbert, 1972). The separation of this element from others may be of use in explaining rated behaviour differences when groups are divided by sex, social class, or other broad classifications. Competence items were, therefore, included in the scale devised by the author and described later in this article.

In addition to a possible Competence cluster, it would seem possible to subdivide the quadrants of the extraversion-neuroticism plot into smaller segments than the very broad groupings of Personality and Conduct problems. Some of these segments will be well out on one pole of the extraversion-introversion axis, but not on the neuroticism axis, thus describing extraverts or introverts without much admixture of the neuroticism components, and yielding a cluster or clusters relatively distinct from the groups describing the unstable varieties. In children, such items will describe their degree of contact with (or contact-seeking towards) adults and children, thus yielding two possible clusters of items, since they could show one degree of extraversion towards adults and other towards their peers. One problem is that it is very difficult to write ' pure ' extraversion items in behaviour-rating scales : so many of the cues for gauging social adjustment (the neuroticism or stability dimension) are linked with the degree of social mixing, social skill, or surgency. However, the instrument to be described later did include some items attempting to measure examples of social extraversion towards adults and children.

To summarise the preceding discussion, there appear to be four or five clusters which it may be useful to seek in teachers' ratings :

A. Personality problems or introverted neuroticism.
B. Conduct problems or extraverted neuroticism.
C. Competence.
D. Social extraversion towards adults. }
E. Social extraversion towards children } Perhaps one cluster.

METHODS

(i) *Construction of scale.*

After pilot work and the consideration of existing scales, 49 items were chosen. Each item was assigned tentatively to one of the groups A—E, but there were many doubtful ones : this was deliberately the case, since the pool was constructed to cover most of the items used in other behaviour rating scales (mainly Cattell, 1963 ; Rutter, 1967 ; Stott, 1966), it being necessary to avoid merely writing items around narrow themes corresponding to the hypothesised domains A—E. The instrument was named the Social Behaviour Rating Scale (SBRS).

The format of the scale departed from the common custom of providing a title or description followed by a numerical rating on a two or three-point continuum. One problem with this practice is that distributions are often heavily skewed. Another is that raters may find it difficult to be objective when they are rating a characteristic which is really one pole of a much wider continuum. Therefore, in all items of the author's scale both poles are presented at once : for example, instead of rating the child on ' aggression,' the teacher is asked to place the child on a continuum ranging from ' submissive ' through a midpoint to ' aggressive.' To aid this, the continuum was broken down into five points, with the two extremes and midpoint defined by wording. The layout of each item was as follows :
example :

Desire for sympathy from staff

X	X	X	X	X
Always comes up with minor hurts or tales of being wronged by others		Does not make an unnecessary fuss		Keeps his grievances, if any, away from adult's sight

The rater was asked to ring one of the five Xs.

The level of abstraction in the wording was selected to be moderately rather than extremely low : items do not usually refer to very behavioural sequences such as facial expressions, etc., nor do they refer to abstract inferential concepts such as reticence, responsibility, stability, etc. Nunnally (1967) mentions the difficulty of writing extremely behavioural continua, especially with factor analysis in mind.

The items were arranged in four groups : The Child and other Children, The Child and Adults, The Child in School, and General Trends. The subdivision was made in order to disguise the factorial hypotheses, and to avoid the tedium of rating on an undifferentiated list of items (pilot work with a completely randomised scale had produced this reaction). Each section contained a mixture of items, as far as possible arranged so that raters would not be affected by logical sequences, response sets, or subject-matter similarities.

(ii) *Subjects and factor analytic procedure.*

A total of 141 boys were subjects, all being residents of a large Midlands city. They were those with ratings available at a particular point in the course of two ongoing research projects. Table 1 gives the social class distribution.

TABLE 1

PERCENTAGE DISTRIBUTION OF SAMPLE ACROSS REGISTRAR-GENERAL'S SOCIAL CLASSES.

	I and II	III	IV	V and Chronic Unemployed	Totals
Sample A ...	34	43	14	9	100
Sample B ...	0	47	31	22	100
A+B	16	45	23	16	100

One sample (A, N=70) drew subjects from a wide area but the boys with completed ratings at the time of the present study were distributed with an excess in the non-manual occupations. The other sample (B, N=71) was selected from the inner-ring area, and its subjects were distributed from the middle to lower end of the social scale. Research A took boys by alphabetical order of surnames, the teachers contributing five or ten boys according to their willingness to help. This sample drew from eight schools, one teacher per school. Research B aimed to use trios of boys selected as coming from three roughly equal-sized social strata identified in the inner-ring area. Social class was a major constituent of the social stratification instrument. The sample was spread over 17 schools and 14 teachers, who had at the time of this study rated between one and six boys each. Thus, although the selection procedures were different, the combined result of the two samples is a good cross-section of the city, and no source of bias in terms of factor structure can be anticipated. The mean age was 10¾ years (range 10–0 to 11–7). The study was limited to boys because this was required by the main research project on which the author was engaged (Phillips *et al.*, 1972) ; in defence of this, it may be pointed out that there could be a difference in factorial structure of boys and girls (Zax *et al.*, 1964).

Each item was scored as a continuum of 1–5 points, the direction of scoring being decided by a tentative allocation to one of the domains A–E. The scores were intercorrelated and subjected to a computerised principal components analysis, followed by rotation to the promax analytic criterion of oblique simple structure (Hendrickson and White, 1964).

Nine principal components had latent roots over 1·0, accounting for 66·9 per cent of the variance. On rotation the first four factors were clearly representative of the A, B, C and D domains, but the remaining five were difficult to interpret and often appeared to overlap each other or one of the more substantial factors as is shown by their intercorrelations in Table 2. A second rotation was therefore performed using only the first five principal components, to see whether the E domain would emerge as the fifth factor. This was, indeed, the outcome. The promax loadings on these five factors are given in Table 3. The item titles are abbreviated versions, the full text of each item being too lengthy to include here. In several cases an item did not turn up in the factor originally hypothesised, but in Table 3 each item is placed to show the final picture.

TABLE 2

MATRIX OF CORRELATIONS BETWEEN NINE PROMAX FACTORS.

	I	II	III	IV	V	VI	VII	VIII
I=B—	—							
II=C—	—09	—						
III=D—	34	01	—					
IV=A+	16	39	—08	—				
V	—10	32	—01	23	—			
VI	05	—03	15	08	—13	—		
VII	—40	—04	—13	—23	—05	—02	—	
VIII	01	—58	—01	—33	—38	08	12	—
IX	—15	—24	—15	—21	—22	17	34	24

Decimal points omitted.

The A and C dimensions emerge clearly as does the B group, although it is somewhat larger than hoped for and the A group somewhat smaller. The size of the B group is probably due to the pervasive influence of introversion-extraversion, or to generalised assessment of troublesomeness by teachers. The D and E groups show several loadings over ·30 on other factors, indicating that they lack homogeneity. The second order factors, obtained by factorising the correlations in Table 2, are of interest in summarising the relationships between the first order dimensions. These relationships can be interpreted according to the theoretical framework of Hallworth and others. When principal components were extracted from the correlations in Table 2, three axes had latent roots over 1·0 and were rotated to the varimax orthogonal criterion (Kaiser, 1958). Interpretation was as follows:

Second Order Factor I (24·9 per cent of the variance): A strong dimension of A(+) and C(—), together with those E items which reflect good social skills *versus* isolation or inhibition. This seems to be a factor strongly akin to a version of Hallworth's ' Good Pupil ' or Stability factor, perhaps rotated since it has an element of introverted neuroticism.

Second Order Factor II (19.9 per cent of the variance): This is loaded by the B and D items, and the two remaining E items, ' Jealousy ' and ' Desires friendships.' This looks very like a ' Potency ' dimension in the Hallworth/Osgood Scheme, although the ' instability ' brought in by the B scale items indicates that it may be rotated through 45° to make an axis of extraverted neuroticism.

Second Order Factor III (13·5 per cent of the variance): This picks out only three items loading over ·30—' Desire for friendships ' (does not seem bothered whether others like him), ' Seeks out others ' (negative) and ' Jobs outside class ' (does not spontaneously undertake and does not manage well). This factor may be tentatively identified as an 'Activity ' dimension on the Hallworth/Osgood model.

TABLE 3

SOCIAL BEHAVIOUR RATING SCALE. LOADINGS OF ITEMS ON FIVE PROMAX FACTORS.

Item No. and brief title		Factors				
		I=B	II=C	III=D	IV=A	V=E
25	Aggression	*−94*	−09	17	13	02
16	Domination of others	*−85*	−27	02	−03	−02
4	Resentful of correction	*−84*	−09	15	19	12
20	Shows off	*−80*	04	−13	−11	−07
44	Noisy	*−80*	18	−08	−01	−09
40	Tempers	*−77*	07	−01	22	06
49	Excitable	*−77*	12	−10	11	−22
34	Plays Up	*−73*	21	−09	−09	−02
48	Fidgets	*−69*	*33*	14	22	−17
13	Defiant	*−64*	−11	−06	*−31*	07
52	Tells lies often	*−64*	*31*	−03	−09	13
19	Won't share	*−60*	15	00	−20	22
45	Bold	*−55*	02	*33*	*−49*	−20
50	Steals	*−55*	*35*	−08	−03	05
30	Impulsive	*−54*	−18	−20	−07	−07
42	Hyperactive	*−46*	−20	−17	−21	−01
35	Oversure	*−44*	*−47*	−08	−27	01
37	Perseverance	01	*−88*	11	12	−09
46	Concentration	01	*−88*	13	28	−07
14	Good at class jobs	−01	*−82*	−15	−01	01
7	Self sufficient	01	*−82*	08	−12	15
39	Desire to do well	04	*−81*	03	25	−18
41	Imaginative	−27	*−78*	−04	03	04
32	Stable choices of work	04	*−77*	05	−04	01
2	Grasps instructions	−06	*−74*	04	−27	13
29	Tidy, orderly	16	*−67*	00	13	06
11	Jobs outside class	18	*−59*	22	−08	−04
33	Composure in difficulties	24	*−53*	07	−21	−06
17	Useful help to others	20	*−47*	−23	05	*−40*
8	Seeks praise from adult	−06	−03	*−78*	10	−07
12	Communicates ++ with adults	−05	08	*−70*	−17	−10
10	Seeks sympathy	*−33*	−01	*−58*	28	−04
5	Clings	17	10	*−57*	*38*	−14
3	Demands attention	*−52*	−05	*−53*	01	03
6	Approaches visitors	*−33*	−05	*−43*	*−32*	−03
38	Easily flustered	06	10	17	*77*	*−31*
43	Worried look	15	−05	02	*74*	14
31	Easily upset by change	03	−29	−26	*73*	02
47	Depressed moods	−21	−15	12	*66*	10
51	Mannerisms	−13	10	10	*53*	−07
36	Uneasy in school	−09	16	−08	*36*	29
26	Welcomes group work	10	03	−26	03	*−66*
22	Invites others to join in	00	−13	06	−03	*−66*
24	Desires friendships ++	−29	−10	*−31*	27	*−58*
18	Seeks out others	*−56*	11	09	−05	*−57*
21	Popular	12	−23	13	−19	*−48*
9	Trustful	*−53*	*44*	−23	−28	*−41*
15	Relaxed in contacts	−19	*−36*	01	*−38*	*−31*
23	Not jealous	*36*	−06	25	−25	*−35*

Decimal points omitted.

Loadings *in italics* are those of ±·30 and over

DISCUSSION

The five-dimensional scheme given in the Introduction was in general borne out, although the heterogeneity of the D and E groups indicates the difficulty of writing 'pure' introversion-extraversion items in this context. Perhaps rewording and further analysis would yield larger groups of items less likely to load on instability factors. Despite this weakness, the SBRS does seem able to yield five fairly distinct groups of items. Some discussion of the status of these groups is necessary.

The evidence of Hallworth's work, and recently that of Cookson (1973) is that teachers' notions of stability in children are heavily linked up with their general approval or disapproval. The present work used many more items than the global ratings used by those authors and by others such as Eysenck and Cookson (1969) and Eysenck and Pickup (1968). The indications are that, when they are given such a manifold set of behaviours to consider, teachers do not merely employ a single concept of approval/disapproval when rating, but use a conceptual scheme which does differentiate between 'badness' in the sense of low Competence (poor motivation, lack of persistence, etc.), 'badness' in the sense of naughtiness (aggression, definace, playing up, etc.), and 'badness' in the sense that being an introverted neurotic is bad. All these elements may be compounded when the teacher is asked merely to rate 'Stability.'

The ability of teachers to make fine discriminations when rating (which, oddly, many psychologists seem to doubt) yields the factors found in SBRS at the first order level. At the second order level the structure coalesces back to something nearer the Hallworth model, although the inclusion of 'problem' items seems to have produced dimensions where the first two both tap instability. This is no indication that teachers are really rating on just two dimensions, such as 'good-bad' (or stability) and 'social extraversion.' The number and type of dimensions depends on the number and type of items, although there may well be a limit to their number in terms of usefulness and reliability.

The factor analysis reported here has been used to form subscales for the SBRS. Data on norms, validity or reliability are at a preliminary stage only, but so far have been satisfactory. Details of this may be seen in Herbert (1973). Specimens of the scale may be obtained from the author, who would welcome further studies.

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SUCCESS AND FAILURE AMONG ENGINEERS, PHYSICAL SCIENTISTS AND LINGUISTS AT A TECHNOLOGICAL UNIVERSITY

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SUMMARY. Academic performance in three fields of study, engineering, physical sciences and languages, has been analysed by comparing the characteristics of successful students with those of the less successful and those who failed to graduate. The students obtaining the better degrees generally had the better entry qualifications, and in engineering and the sciences, had reacted less against the industrial training element of sandwich courses. No strong relationship between social class and academic performance was found in engineering and the sciences, but, in languages, the successful students tended to come from non-manual backgrounds, and it is speculated that their acknowledged greater flexibility in their native language may have generalised to foreign languages. In a study of student worries it was found that those who were to go on to do less well or not graduate at all, were apparently aware of their difficulties at an early stage, and able to articulate them.

INTRODUCTION

In a previous paper (Smithers and Batcock, 1970) the bearing of a number of factors on the degree performance of health-science and social-science students at the University of Bradford was examined. In both fields of study working class students tended to be the more successful, and since both admitted about twice as many middle as working class students, this was taken as some support for Dale's (1963) hypothesis that, where it is difficult for a working class student to gain entry to a course, performance will be related inversely to social class.

Success in both fields was related to A-level performance and intelligence as measured by the Nufferno Level Test (Furneaux, 1956), but the importance of other factors depended on field of study. Introversion and open-mindedness appeared to be an advantage in the social sciences, but not the health sciences. Success in the professionally-oriented health sciences was related to the strength of occupational motivation.

In contrast to previous studies at Bradford (Cohen and Child, 1969) students leaving prematurely did not report finding the university environment more worrying than those who successfully completed their courses. Neither did a measure of academic ' focusing ' (Musgrove, 1969) distinguish the successful and less successful.

The social scientists and health scientists of Smithers and Batcock's (1970) study were taking three-year full-time courses. The other students—of modern languages, physical sciences and engineering—were on sandwich courses, and graduated one year later. In this paper, we examine the bearing of the same factors on the performance of these students.

METHODS

All 459 students who entered the Schools of Engineering, Science and Languages in 1966 to take four-year courses have been classified according to their degree result. Those who obtained firsts or upper seconds have been classified as having 'good degrees,' those obtaining lower seconds, thirds and passes as 'other degrees,' and those failing to graduate on time as 'no degree.' This last category is a heterogeneous one including both those who left through examination failure, and those who left of their own accord.

The students fall fairly naturally into three subject groups: (i) Engineering (Schools of Chemical, Mechanical, Electrical and Civil Engineering); (ii) Physical Science (Schools of Chemistry, Physics, Materials Science, Mathematics and Statistics); and (iii) Modern Languages (School of Modern Languages). There were only three female engineers and nine female physical scientists and they have not been included in the present study. The distribution of the rest of the sample is shown in Table 1.

TABLE 1

Distribution of Sample.

Field of Study	Good Degree		Other Degree		No Degree	
	N	per cent	N	per cent	N	per cent
Engineering (N=281)	66	23·5	145	51·6	70	24·9
Languages (N=55)	18	32·7	26	47·3	11	20·0
Sciences (N=111)	25	22·5	65	58·6	21	18·9

On entry to the university the students completed intelligence and personality tests, and measures of academic and occupational motivation (see Smithers and Batcock, 1970, for details). The students' social class background and A-level performance were ascertained from their registration forms. Social class was obtained by classifying father's occupation on the Registrar-General's scale and A-level results were divided, following the UCCA, by taking as 'good' any combination of three A-level passes equivalent to or better than CCC, or two A-level passes AA or AB.

The students were followed up after one term in the university when they completed a problem checklist, and at the end of their second academic session when some of the original questionnaires were administered again.

The subjects of this study were sandwich course students and their reactions to the industrial training element in their courses were assessed using a Likert-type scale of attitude to industrial training which ranged from 30–150, the higher the score the more unfavourable the attitude (Musgrove and Smithers, 1969).

RESULTS

The data of Table 2 show that the relationship between examination performance and social class background depended on field of study. Among both the engineers and scientists, where roughly equal numbers of students from manual and non-manual backgrounds were admitted, there were no significant differences with social class in the proportions obtaining good degrees or graduating. But, in modern languages, students from non-manual backgrounds were not only admitted in greater numbers, but also did markedly better than their working class contemporaries.

TABLE 2

SOCIAL CLASS BACKGROUND : PERCENTAGE DISTRIBUTION.

Registrar-General's Classes	Per Cent			χ^2	P(df2)
	Good degree	Other degree	No degree		
Engineering :					
I–IIIa (N=149)	19·46	53·69	26·85	3·35	NS
IIIb–V (N=125) ...	28·80	48·80	22·40		
Languages :					
I–IIIa (N=34)	47·06	32·35	20·59	9·80	·01
IIIb–V (N=21)	9·52	71·43	19·05		
Sciences :					
I–IIIa (N=48)	27·08	54·17	18·75	1·06	NS
IIIb–V (N=63)	19·05	61·90	19·05		

Seven engineers could not be classified because of a lack of information.

In Table 3, students' performance is related to their entry qualifications. Students can enter the schools of engineering either on the basis of A-level attainment or good ONC passes. As the data of Table 3 show, students entering with good A-levels tended to do significantly better than those with poor A-levels and those entering on ONC qualifications. The ONC students did just as well as those with poor A-levels. In modern languages, there was a strong relationship between previous attainment and degree performance—none of those entering with poor A-levels getting a good degree.

TABLE 3

EDUCATIONAL QUALIFICATIONS . PERCENTAGE DISTRIBUTION.

	Per Cent			χ^2	P(df2)
	Good degree	Other degree	No degree		
Engineering :					
A-levels :					
Good (N=52)	36·54	50·00	13·46	G/NG 6·84	·05
Not good (N=183)	21·31	51·91	26·78	G/ONC 6·85	·05
ONC (N=38)	15·79	52·63	31·58	NG/ONC 0·74	NS
Languages					
A-levels :					
Good (N=42) ..	42·86	45·24	11·90		
Not good (N=13)	0	53·85	46·15	11·55	·005
Sciences :					
A-levels :					
Good (N=21)	33·33	47·62	19·05	1·78	NS
Not good (N=89)	20·23	60·67	19·10		

Eight engineers and one scientist not included.

Aspects of personality were measured, but none was clearly related to degree performance. There was some tendency for the more extraverted students to fail in modern languages, and the more stable ones to get the better degrees in engineering, but in each case $P < {\cdot}10$. Intelligence as measured by the Nufferno test was predictive to some extent of degree performance in engineering and the sciences, but not in languages.

Motivation towards study at a technological university as assessed by the proportion of UCCA choices given to the former CATs was not related to eventual performance there, neither was satisfaction with career prospects on entry. However, there were strong indications that the student's experience of industrial training, which is a feature of degree courses at the technological universities, was related to progress. Table 4 shows that over a period of two years the attitude to industrial training of all groups of students became less favourable, but the greatest deterioration occurred among those students who did not graduate. In an intercorrelational analysis of the responses of 249 engineering and science students who graduated, and completed all questionnaires, attitude to industrial training ($r=0{\cdot}154$, $df=248$, $P<{\cdot}05$) was more strongly related to degree performance than any of the other variables in the study including neuroticism, introversion, intelligence, dogmatism, level of aspiration or social class. In varimax analysis, a factor accounting for 15·6 per cent of the variance was extracted on which only attitude to industrial training (0·78) and intelligence (0·60) loaded significantly with degree performance (0·48).

TABLE 4

REACTIONS TO INDUSTRIAL TRAINING BY DEGREE CLASSIFICATION.

	Good Degree		Other Degree		No Degree	
	M	SD	M	SD	M	SD
Engineers :						
1966 (N=275)	60·4	8·2 (65)	61·4	9·8 (141)	62·9	11·5 (69)
1968 (N=159)*	73·4	14·1 (52)	75·9	15·8 (97)	86·4	24·5 (10)
Science :						
1966 (N=110)	60·3	12·7 (25)	62·2	9·2 (64)	64·4	9·3 (21)
1968 (N=57)*	70·5	11·0 (17)	69·6	12·7 (36)	80·8	14·4 (4)

* Numbers lowered by drop-out, non-response and the unavailability of Schools of Physics and Material Science for testing.

Students of engineering who failed to get a degree had at the end of their first term in the university indicated that they found courses more worrying than those students who were more successful. Four problems, in particular, differentiated the successful and less successful (Table 5), including worry over career prospects, being bored by some of the work, being unsure of abilities and feeling overwhelmed by academic work. Data reported elsewhere (Smithers and Melrose, 1973) links industrial experience with worry over career prospects.

Although not strongly related to degree performance in the correlational analysis, there is evidence that level of aspiration on entry is related to success.

TABLE 5

PROBLEMS INDICATED BY ENGINEERING* STUDENTS.

Problem	Per Cent			χ^2	P(df2)
	Good Degree (N=30)	Other Degree (N=70)	No Degree (N=28)		
Worry about your future career prospects	10·0	22·8	42·8	8·67	·025
Feeling overwhelmed by academic work	26·6	47·2	60·6	6·98	·05
Being bored by some of your work	26·6	35·7	64·3	9·65	·01
Being unsure of your abilities	10·0	31·4	50·0	11·00	·005

Autumn intake only.

Among the engineers and scientists, 26·3 per cent of those with high aspirations obtained good degrees compared with only 14·1 per cent of those indicating lower aspirations. In languages, 52·6 per cent of those with high aspirations as opposed to 18·8 per cent with lower aspirations obtained good degrees. These differences were maintained over two years.

DISCUSSION

Examination performance was again found to be related to social class background, but the nature of the relationship varied with field of study. In the engineering and science schools no significant relationship was evident, but in modern languages a strong positive relationship was found. The findings of Smithers and Batcock (1970) with social and health scientists provided some support for the notion of an inverse relationship between performance and ease of access (Dale, 1963). But among the linguists of the present study a very different pattern was found. Not only were proportionately more students from non-manual backgrounds admitted to the course, but they also did markedly better. Thus, the greater linguistic flexibility of those from middle class backgrounds (Bernstein, 1971) may apply not only to the native language but also to foreign languages.

The more successful language and engineering students, like the more successful health and social scientists of Smithers and Batcock's (1970) study, tended to be better qualified on entry, a finding which accords with much previous research (Miller, 1970). In engineering, a student who had had the more practical education of an ONC course did not, in general, do as well as the student who entered with a good A-level record. Previous research (Jahoda, 1963; French, 1967) has not shown the ONC entrant to be at a disadvantage in academic examinations compared with the A-level entrant, but the level of GCE performance has not usually been taken into account.

The lack of significant relationships between personality and performance in this study contrasts with findings reported in Entwistle (1973), but is in keeping with the work of Kline and Gale (1971). Eysenck (1972) has expressed his disappointment with the poor progress that has been made in the study of personality and attainment, and attributes this to over-simple theoretical and methodological approaches. It is possible that with a different form of analysis (cf. Smithers, 1973) some relationships would have been found, but it remains that none of the effects was sufficiently powerful to show up here.

The apparent dependence of degree performance on reaction to industrial training is very interesting. Students entering technological universities tend to be very enthusiastic about the prospect of related work experiences, but to be rather disappointed with how it works out in practice (Jahoda, 1963 ; Smithers, 1971). Musgrove and Smithers (1969) showed that dissatisfaction with industrial training may be a factor in early withdrawal from a technological university. This is in accord with the demonstration in the present study that among the students who remained to complete their courses there was a relationship with academic performance—the more dissatisfied taking the poorer degrees.

Inquiries among students about their problems and worries indicated that, in engineering particularly, students who were eventually to fail to graduate, or to go on to take the poorer degrees, were aware of their difficulties at an early stage, and able to articulate them. This has obvious implications for student counselling. Students on sandwich courses have a chance to try out possible future careers while still at university. The high proportion of students, particularly the drop-outs, who expressed worry over career prospects may have been a comment on this experience (Smithers and Melrose, 1973).

The approach of this study has been to look for the common characteristics of students who have either done well or fared badly in their chosen field of study. This ' always under any conditions ' kind of approach has been rightly criticised by Eysenck (1972) as over-simple. Nevertheless, it has been possible to see that the eventual academic performance of a student is usefully indicated by his previous attainment, and by his acceptance of, and adjustment to, curricular provisions. This emerges strongly in relation to the sandwich system of technological universities. Within particular fields, other factors, for example occupational motivation, may assume importance. However, as has been argued elsewhere (Smithers, 1973), it is one thing to recognise the importance of various factors in academic performance, quite another to turn them to practical advantage for selection purposes.

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PRODUCT AND PROCESS IN COGNITIVE DEVELOPMENT: SOME COMPARATIVE DATA ON THE PERFORMANCE OF SCHOOL AGE CHILDREN IN DIFFERENT CULTURES

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SUMMARY. In the search for factors affecting the 'educability' of children, tasks derived from the theoretical positions of Piaget and Bruner were administered to children of primary school age in three cultures. The sample, of total size 1,536, was drawn from New South Wales, Australia, Papua, New Guinea and children of non-English speaking migrants in Sydney, Australia.

Instruments were designed or adapted to minimise difficulties of cross-cultural application. The tasks were divided into two groups—'product' (getting it right) and 'process' (how it was done). Behaviours, representative of development according to the theories of both Piaget and Bruner, were found in all three cultures. The order of difficulty of the product tasks, with some minor exceptions, was the same for all three, whether the children had been to school or not. The Bruner process tasks presented a different picture. There were material differences from culture to culture in the order of appearance of various identifiable processes. As difficulty of task increased, the process commonly used by the children of each culture changed. With the most difficult tasks the children from all cultures tended to use the same process. Some implications of the findings are discussed.

INTRODUCTION

THIS paper reports some comparative findings on the cognitive development of children living under different cultural conditions. The data are part of a larger study of the factors which affect 'educability,' broadly defined in terms of probability of learning in a school situation. Our emphasis has been on 'probability' of learning rather than 'potential' for learning which seems to us a somewhat barren educational concept when considered in the light of known data about influences on learning of such factors as intrauterine environment, birth traumata, nutrition, social class, language and general attitudes to schooling, not to mention the total teaching-learning environment of the school. That is, *from the point of view of the educator at least*, the nature-nurture controversy in the form recently stated by Jensen and others, is a non-question.

Our basic concerns are with children's learning strategies and styles, with the factors which influence their achievement in school situations and hence with the extent to which they are likely to be able to absorb materials presented to them. An analysis, in some detail, of this point of view may be found in Philp (1967).

Our first set of studies, on which we report here, has concentrated on cognitive development for two basic reasons: first, because, rightly or wrongly, the major emphasis in schooling, at all levels, is on the attainment of cognitive knowledge and skills; and second, in order to develop some base-level data for analysis in relation to other factors like nutrition, cultural attitudes and teaching-learning situations.

Our theoretical interest, in this cognitive area, has centred on the formulations of Jean Piaget and J. S. Bruner : Piaget, because of his influence on curriculum development and Bruner in view of the implications of his writings for theories and methods of instruction. In this paper we have taken the attitude that the work of both is so well known as to need neither further description nor analysis. However, it is of some moment to comment that there has been little testing of the validity of either position in non-western cultures ; such data as do exist, particularly in replications of the work of Bruner and his colleagues, tend to focus on one experiment or another and there are, indeed, few studies, if any, which report use of more than one measure on the same sample. Further, there are no studies, to our knowledge, which report on a direct comparison of Piaget's findings with those of Bruner—complementary though their approaches appear to be.

Our immediate objectives, therefore, have been

(*a*) To determine whether some of the findings of Bruner and Piaget ' stand up ' in non-western cultures.
(*b*) To explore the relationships between the results of Piaget-type and Bruner-type investigations, with both western and non-western groups.
(*c*) To look at the implications of both (*a*) and (*b*) for curriculum development and teaching-learning.

We argued that, if we were to examine these ideas in any meaningful way, we would need to define a set of measuring instruments and to apply them, under as comparable conditions as possible, in a number of different socio-cultural areas.

We argued further that we would have to attempt to keep test instruments and test administration as constant as possible across the samples. That is, we considered that it would not suffice to compare our results with western and non-western data obtained by other research workers. We would have to do our own measurements in a number of different cultures. Furthermore, as far as possible, we would have to draw comparable samples across cultures in terms of age and sex, and would have to have the tests given by the same people, or where there were language difficulties, at least supervised by the same people.

SAMPLING

In the event we sampled (i) children of Australian born parents living in New South Wales (N=656) ; (ii) children of non-English speaking migrants living in New South Wales (N=448) ; (iii) children from three different areas in Papua and New Guinea (PNG) (N=432).

A special problem arose in sampling by age. Our intention had been to follow standard practice and to sample children in a number of age groups. This proved impossible in PNG. With the exception of a very few missions, birth dates are not recorded and ' ages ' are usually ' guestimated ' by teachers or patrol officers—with curiously anomalous results. We, therefore, fell back on ' years of schooling.' Clearly, this is highly correlated with chronological age in societies, like that of New South Wales, in which there is a compulsory age of entrance to school, and, for the great bulk of children, automatic promotion from grade to grade. In most developing countries—and New Guinea is perhaps the type case—the correlation is neither high nor linear. Children in the PNG schools sampled appear to enter school at any age from 5 to 14 or 15 and there is a certain amount of grade repetition. These facts must be kept carefully in mind when considering our interpretations of the results which follow. Details of all three samples are shown in Table 1

TABLE 1

DESCRIPTION OF SAMPLE

	Years of School							
	School 1		School 4		School 6		Totals	
	M	F	M	F	M	F	M	F
NSW	120	120	106	106	102	102	328	328
Migrant	74	75	74	75	75	75	223	225
PNG School	36	36	36	36	36	36	108	108
PNG Village ...	36	26	53	31	30	40	119	97

NOTE: PNG Village children have no ' years of schooling ' They have been divided into three groups equated in ' age ' with PNG school sub-samples. In the sampling procedure in PNG every attempt was made to match each school child with a village child from the same culture/language area in age and sex

(i) *The New South Wales (non-migrant) Samples.*

Primary schools were drawn, using random number tables, from official lists; within schools and grades children were drawn for testing according to a balanced design, again using standard tables. In cases in which a child proved to be a 'migrant,' as defined below, he was replaced, using conventional sampling methods. Both urban and rural schools were included, in an attempt to compare the performance of city and country children.

In New South Wales, ' 1 year of school ' corresponds, at the time of testing, to a mean age of 6·5 years, plus or minus six months, ' 4 years of school ' similarly corresponds to 9·9 years, plus or minus six months, and ' 6 years of school ' to 11·9 years, plus or minus six months.

(ii) *The New South Wales ' migrant ' Samples.*

This was drawn in a similar manner to that used for the general New South Wales sample, from which migrant children were rigorously excluded. A ' migrant ' was defined, for our purposes, as a child whose parents had come to Australia as adults, from a non-English speaking country.

The sample was limited to schools in urban Sydney. Demographic evidence suggests that outside this area the settling pattern of migrants is somewhat peculiar and any attempt at formal probability sampling would have been inordinately costly, since sample size, in order to assure a reasonable representation of all cultural-linguistic groups would have been very large. Strictly speaking, therefore, the migrant sample is comparable with the urban New South Wales sub-sample.

Children born outside Australia of migrants who spoke English as a mother tongue were excluded, as far as possible, from both sample sets (i) and (ii).

The relationship between age and years of schooling in the migrant sample is much the same as in the New South Wales sample, except that the migrant children tend to be six months older, grade for grade.

(iii) *The Papua-New Guinea Samples.*

Our original, ideal plan was to obtain samples from three different cultural-linguistic areas, with children in each sample matched in terms of sex, age, years of schooling and attendance and non-attendance at school. This last was an attempt to investigate the effect of schooling on performance in typical cognitive tasks. Since, in many village areas, roughly half the children attend school and half do not (with the criteria for attendance fairly random) Papua-New Guinea seemed an ideal laboratory for such an analysis. The matching was not ideal. This was essentially because it was sometimes difficult to persuade parents to walk their children for three or four days over rough mountain jungle or paddle them in canoes against a 10-knot current in order to play games with mad white men !

Children attending school are designated ' school ' ; those who have never been to school we have termed 'village' children.

THE INSTRUMENTS

We were interested, not only in what children could do, but in the way they went about it. That is, we accepted the distinction made by Bruner (1966) between knowledge as ' product ' (Piaget's ' connaissance ') and the ' process ' of acquiring knowledge or of attacking (although not necessarily solving) problems. It should be noted that we made no assumption about ' learning ' in the conventional sense. We selected a series of tasks, some of which purported to measure 'product' and others ' process,' and which met certain additional criteria :

(*a*) Appropriateness, according to Piaget's or Bruner's data, for use with children of primary school age (i.e., about 5-13).
(*b*) Relevance to the central position of either Piaget or Bruner.
(*c*) Probable face validity in terms of possibility of reliable administration, under very different physical and cultural conditions. That is, we wanted to be reasonably sure that the instruments could be understood and used as readily in the New Guinea jungle as in sophisticated school conditions in Sydney.

The final selection of instruments was somewhat greater than reported here, but we describe a set of those which (*a*) ' worked ' in the sense of being meaningful to the children of all groups, and (*b*) provided comparable data. Some of our instruments were ' culture specific ' and form the basis of a later report.

A. *Product-Type Tasks—Mainly Derived from Piaget.*

(1) *Conservation of quantity.* Rice was used because of its wide familiarity. Clear plastic containers were obtained :

(*a*) 2 standard, identical with each other (4-in. high × 1½-in. diameter).
(*b*) 1 wider, but more shallow, than standard (2-in. high × 3-in. diameter).
(*c*) 1 taller and thinner than standard (6-in. high × 1-in. diameter).

Two questions were asked : " Is there the same amount . . . ? " " Is there more here ? " Both questions were to be answered correctly, using the formal Piaget-type criteria, i.e., the child had to be able to identify conservation and to give an acceptable reason.

(2) *Conservation of Length.* Two sticks of local material were used. In New Guinea these were two eight-inch lengths of 5/16-in. diameter pit-pit wood. For NSW and migrant children, two 15 cm × 1 cm dressed sticks were employed. Three positions of displacement were used:

(*a*) juxtaposed horizontally and displaced by one-third,
(*b*) separated by 12-in. and displaced by one-third,
(*c*) an inverted 'T' shape.

(The last was originally used in New Guinea to test the 'agreement with experimenter' response.) Two questions were asked: "Is this the same length as that?" and "Is this longer?" Both were to be answered correctly. Again standard Piaget criteria were used to judge success on the task.

(3) *Formal Operations.* The two New South Wales samples were tested using an electrical analogue of the four chemical test (Inhelder and Piaget, 1955). This consisted of four position switches with lamp bezels, one test button and a test lamp. Two switches needed to be 'on' for success with the trial button; one was irrelevant and one prevented the light from coming on. The arrangements could be varied by the operator.

A study of an older, secondary school group in Papua-New Guinea (Jones and Kelly, 1972, unpublished data) has shown that this task could not be successfully solved by any of the children. With the PNG sample with which we are concerned here, we attempted to use a variant of the demonstrably 'easier' pendulum task (Inhelder and Piaget, 1955) using bark strings, a tin can and stones. For both tasks, following Piagetian criteria, the child had to be able to predict the result and state the principle involved for the positive, reversing and negative instances.

(4/5) *Nine Block Matrix* (based on Bruner and Kenney, 1966). Three blocks were of 2-in. × 2-in. cross sections; three were 1½-in. × 1½-in. and three were 1-in. × 1-in. Across this grouping, heights were varied, each cross section set having one 6-in., one 4-in. and one 2-in. block. They were arranged on a 15-in. × 15-in. tray with nine divisions. Two measures are reported:

(4) Ability to replace the three 1½-in. × 1½-in. blocks. This we term 'matrix height.'
(5) Rotation of the matrix through 180° with placement of the 6-in. × 2-in. × 2-in block being used as a cue. This we called 'matrix reverse.'

In each case the original arrangement of the blocks was such that they increased in diameter across one dimension and in height across the other. The criterion for success in both tasks was correct reproduction of the matrix.

That is, in the product group the child had to be able to "get it right" (according to our criteria), and in the first three, Piagetian, tasks he had also to be able to say why.

B. *Process-Type Tasks—Mainly Derived from Bruner.*

(6/7) *Problem Solving.* These tasks used a variation of the Olson bulb board (Bruner *et al.*, 1966) expanded to 10 × 12 bulbs, each independently controlled and connected to a pen recorder (Kelly, 1971a). The two problems reported were:

(6) A two-possibility single line pair of patterns on the full sized 10 × 12 board (BB1).
(7) An eight-possibility single line set on a masked board of 3 × 3 bulbs (BB6).

The patterns of lighted bulbs presented as possibilities were overlapping between any pair of patterns and the subject had to choose the one which had been set on the board by pressing one bulb at a time. This would either light or not, depending on which pattern had been set. The tasks were used to examine the existence of Bruner's hypothesised modes of representation of reality. The subjects' pattern of movements in solving the problems could be accurately and reliably traced.

Responses were scored in terms of the Bruner-hierarchy 'enactive,' 'ikonic,' 'symbolic,' except that we introduced a 'transitional' category between 'ikonic' and 'symbolic.' Many children, in all samples, solved the problems by a strategy which involved pressing a number of buttons in a systematic way and then proceeding to an immediate solution, i.e., they began 'ikonically' and then 'saw' the symbolic completion.

(8/9) *Classification of Stimuli According to Degree of Inclusiveness and Basis of Classification.* With the Papua-New Guinea and New South Wales (non-migrant) samples we used three sets of stimulus objects, together with a word set, all based on the work of Olver and Hornsby (1966). The three object sets were parallel:

(i) real objects
(ii) colour photographs of the real objects, and
(iii) coloured drawings of the objects prepared by an Australian commercial artist.

There were 60 items in each set, consisting of 12 exemplars of each of five hypothesised areas: plant environment, animal environment, technological environment, 'personal' environment and house environment. The exemplars were minimally varied as the sub-sample changed (e.g., 'coconut' changed to 'potato'); subjects were asked to collect any number of items which formed a group and then to state the reason for the grouping. Three trials were given with each set. The word set was modelled on the banana-peach series in Olver and Hornsby (1966) by substituting approximate equivalents from the local culture.

There were very few differences (none of which was significant) among either the PNG children or the New South Wales (non-migrant) children in their responses to objects, photographs and drawings. Accordingly, we used colour photographs only with the New South Wales migrant children and the data on objects and drawings for the other two samples are not reproduced in this paper.*

(8) Photographs
(9) Words: Bases.

Following the Olver-Hornsby model, responses were scored according to the *basis* for the grouping—irrespective of the degree of superordination. Three broad kinds of bases were used in line with Olver and Hornsby (*a*) Perceptible, e.g., "They are all 'red' or 'square.'"; (*b*) Functional, e.g., "We use them all for eating"; (*c*) Nominal, e.g., "They are all tools"; "They are all food."

It will be noted that we used two different scales for classifying process. Bruner and his associates (Bruner, 1966) equate the enactive—ikonic—symbolic hierarchy with the perceptible—functional—nominal scale used for scoring the equivalence material. Our data indicate that somewhat different, although related, cognitive processes may be involved in 'equivalence' behaviour from those required by the 'inferences' implicit in tasks like those of the button board.

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* A detailed description of the stimuli, as used in Papua-New Guinea is given by R. W. Huntsman (Huntsman, 1974).

LANGUAGE OF TESTING

A major problem, both theoretical and practical, arose immediately with both the Papua-New Guinea and migrant groups. In which language should we administer the tests? It could be argued that we should try, as far as possible, to use English, (*a*) in order to maintain consistency of administration, for we had no one who spoke all three Papuan-New Guinea dialects and the several languages of the migrant parents in New South Wales, and (*b*) in order to make the language of the test the language of the school. At this stage, too, we were not prepared to "buy into" the Sapir-Whorf hypothesis, and this consideration required using English as far as possible.

On the other hand, there was a strong case for using vernaculars in Papua-New Guinea and home tongues in New South Wales in order to maximise comprehension. The compromise eventually accepted was not entirely satisfactory; in our view it has affected some of our data—but, more important, it has led on to further studies, which are briefly foreshadowed below. The compromise was this:

(i) the NSW sample was tested in English.

(ii) the NSW migrant sample was tested in English, whenever possible. Where, on pretest, the child did not understand the instructions, he was tested in his home language, using interpreters who were specifically trained. There were, fortunately, very few cases in this group.

(iii) the Papua-New Guinea situation was more complex:

- (*a*) Village children—i.e., those who had no schooling—were tested in the vernacular. For the equivalence material, where a good deal of language was obviously involved, sound tapes were prepared with the assistance of linguists and spoken by local adults. For other tests, where language was minimal, local interpreters (usually children) were employed.
- (*b*) School children in their first year of school were treated as village children for purposes of administration.
- (*c*) School children in later years (four and six years of schooling) were tested in English, as the language of school instruction. An exception was that the vernacular tapes were used in the equivalence tests, although responses had to be given in English. In a later, more intensive study, the school groups were divided into two matched samples of which one was tested in English and the other in the vernacular: for a preliminary analysis of these data see Philp (1973).

RESULTS

It will be apparent that we cannot, in an article such as this, present all our data. We have something like 126 items of test information for each of our 1,536 children, classified by years of schooling, sex, culture and sub-culture (including vernacular language) and all of this has been subjected to somewhat sophisticated statistical analysis. Our immediate purpose is essentially to describe the methodology of the studies and to present some of our major findings in a simplified, graphical form. It is proposed to present the detailed data and analyses at a later stage and it is sufficient to say here that our basic method of analysis was multi-level χ^2 analogous to analysis of variance. Where 'significance' is referred to in the subsequent discussion it is in terms of this analysis.

Perhaps we are being over-cautious but, despite the large sample sizes and the rigour which we imposed on administration, we suggest that our results and our interpretations have to be read with care because of the possible language complication. At this early stage of our studies our principle concern was with ensuring that children knew what they had to do. For the most part the actual language response was irrelevant, for in the studies reported here we tried to record results in terms of observed behaviour. This is, of course, very far from asserting that what went on inside the subject's head in terms of language was also irrelevant; indeed, a great deal of our subsequent work has been related to just this problem and, to anticipate, we are inclined to argue that the interpretation of the problem and the character of the response are affected—if not determined—by the language patterns customarily used by the subject.

(*a*) *General findings.*

When so many possible comparisons are available with groups as large as ours, tests of significance of difference between the samples become almost meaningless. It can be seen from all the graphs, however, that the general trend is for the New South Wales ' old Australian ' sample to solve the product type tasks more frequently, or to be on a higher position in the developmental hierarchy of process use than migrants, who are, in turn, superior to Papua-New Guineans. More important, all behaviours are represented in all samples, save only for formal operations with the Papua-New Guinea sample. The common occurrence of the measured behaviours suggests that it may be reasonably asserted that Piaget and Bruner are both describing universals of human cognitive development. Whether these universals are genetically or culturally determined is another matter. It is possible that capacity to display behaviours such as those described is inherent in the human germ plasm. It is equally possible that there are communalities of cultural patterns in all human societies and that these affect—or even determine—the development of intellectual skills and the ways in which they are used.

At this stage of research we do not know the important variables in any culture which bear upon cognitive development. It is accordingly not possible to determine variables which may be common to the three cultures in which we have worked, despite their apparent diversity, and thus to specify the respective contribution of genetic and environmental factors—even if this were a useful educational aim.

To reiterate, the important finding is surely that the behaviours tested, except for formal operations, have been identified in all three cultures. The failure of the PNG children to solve the formal operations task may be a problem of communication or it may be a time lag effect. Either hypothesis fits the facts. Studies at present (1973) under way in Papua-New Guinea with older children use tasks which may enable the problem to be resolved.

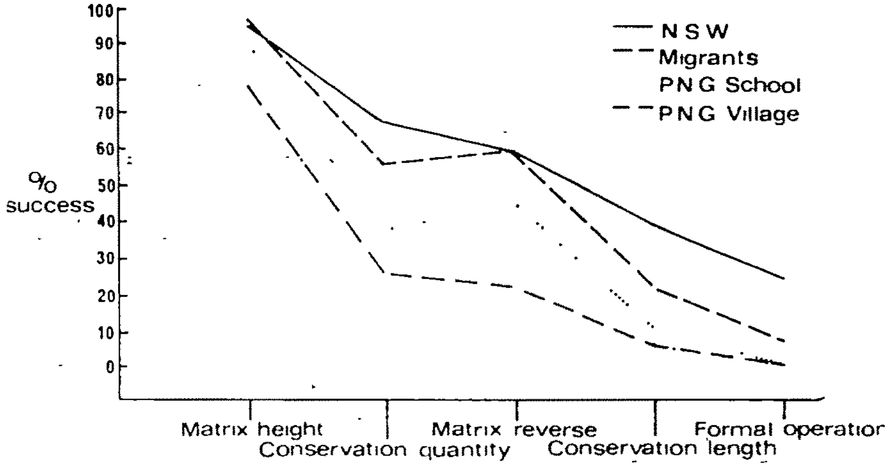
Similarly it is of some importance to note that, in general, the order of difficulty of the product tasks is the same in all four samples (Graph I). The exceptions to this statement are that, for the migrant group and the PNG school group, there is a reversal of the order of difficulty of the conservation of quantity and matrix reverse tasks—if we take as the ' true ' order that of the NSW and PNG village groups. The reversals are significant at the ·05 level. Without suggesting a causal relationship, at this stage, it is of interest that the two groups concerned are those tested in a language other than their vernacular. The matrix tasks are both, obviously enough, similar to problems posed in school situations in which structured materials (like Dienes blocks, for example) are used in the teaching of mathematics. It may be argued that when children are taught in a foreign language, they may well fare better in tasks related to that teaching than in tasks not specifically taught but, nevertheless, tested in that language. The developmental data described below, suggest that the situation is quite complex.

Of more moment is the fact that if we look at the three Piagetian tasks (conservation of quantity, conservation of length and formal operations) the order of difficulty in all four of our groups is precisely that suggested by Piaget—although their median age of attainment, as we shall see below, differs from group to group—presumably because of epigenetic factors. Our data, in this respect, are thus a striking example of Piaget's principle of homeorhesis.

To repeat, what does seem to be of importance is (*a*) that the curves of difficulty are parallel, with the minor exceptions noted, and (*b*) that the differences between groups remain reasonably constant.

GRAPH 1

Product tasks to show order of difficulty by sample



In broad terms—it helps to go to school; it helps even more to go to school where the language of instruction is that of the home; where this is impossible, it helps to go to school where the language of instruction is that of the culture in which the child is living.

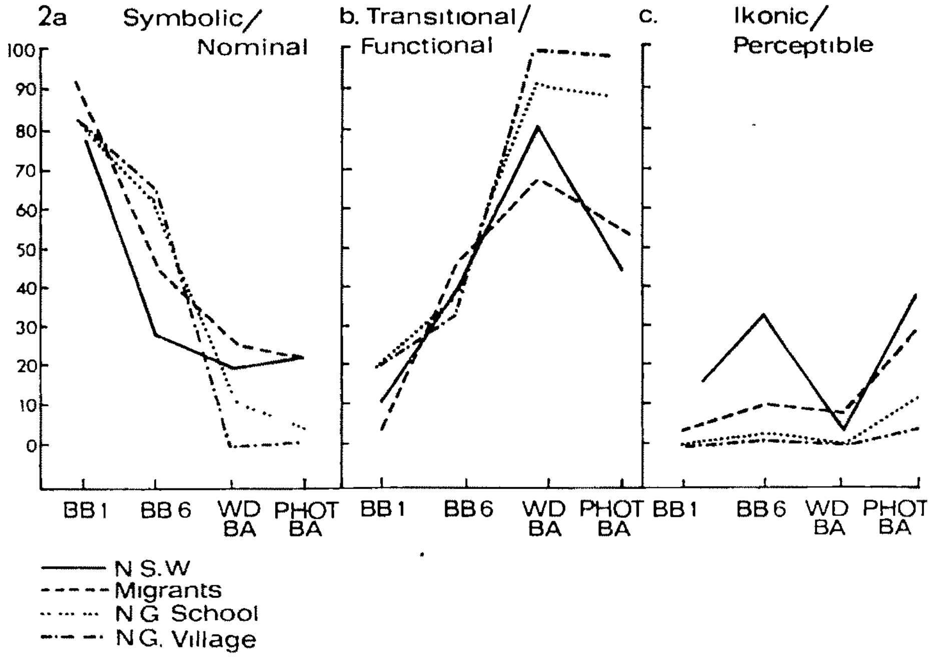
We may now turn to general findings related to *process* (Graphs 2a, 2b and 2c). These are more difficult to interpret, since the classifications of modes or strategies are themselves somewhat subjective. It is perhaps best, for ease of presentation and comprehension, to comment first in terms of Graph 2a—use of the symbolic mode and the nominal base of classification. The general impression, borne out by the χ^2 analysis, is one of parallel curves.

The tasks become harder—in the sense of less probability of use of the symbolic or nominal—in precisely the same order for all four groups. Most children—in PNG village or school, and in New South Wales, migrant or non-migrant—solve the fairly complex BB6 problem by ikonic strategies. Relatively few of them use the nominal base in attacking the words or photographs basis of classification. That there are significant differences between groups, as in the product tasks, is apparent on inspection, but overall, the trend is the same—and this, too, is confirmation of the basic, if not the detailed, positions of both Piaget and Bruner.

One difference among the groups which becomes even more apparent in the development curves, discussed below, is the tendency of all PNG children in our samples to use functional bases of classification, rather than either perceptible or nominal criteria. The two New South Wales samples, on the other hand, although they use functional classes more often than either perceptible or nominal, are much more likely to employ one or other of these latter bases than are the PNG children.

GRAPH 2

Process tasks to show use of strategies by samples % using each strategy



The hierarchy symbolic, transitional, ikonic refers to BB1 and BB6
The heirarchy nominal, functional perceptible refers to bases of classification (see text)

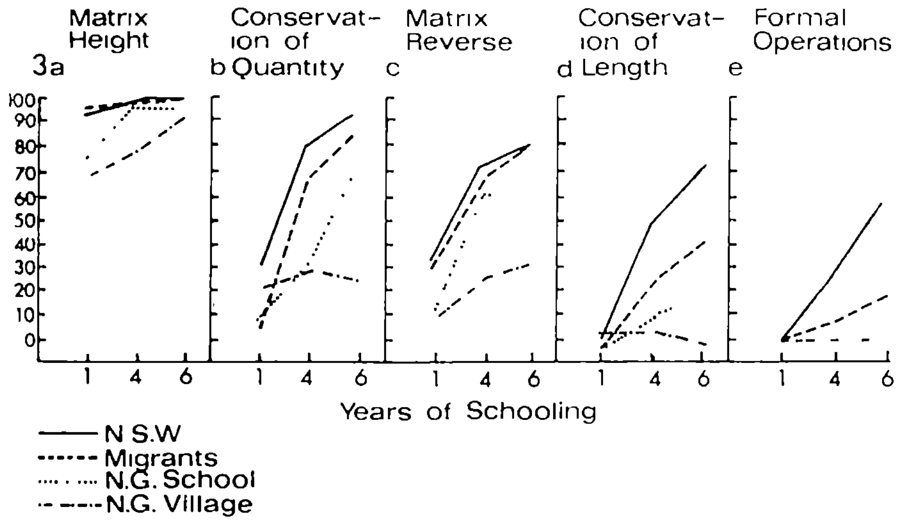
(*b*) *Developmental findings.*

We begin by reminding the reader of the definitions of age and years of schooling, into which we were forced by the nature of our PNG samples. We can say, with some precision, that years of schooling means what it says for the two New South Wales samples and the PNG school group—the number of years for which each child had attended school, with a variation of about ±3 months within each year. For the PNG village sample, however, we are equating, child for child, ' age ' with ' years of schooling.' It is worth emphasising what this means. It signifies that child X, with, say, four years of schooling in PNG, was born in the same year as the matched child Y in the corresponding village sample; it does *not* necessarily say anything about the chronological age of either child, in relation to New South Wales children with the same number of years of schooling.

This said, we now turn to the developmental trends suggested by our curves. The set 3 (a, b, c, d and e) show the trends for each product task in the order of difficulty (a <b <c <d <e) of Graph 1. Overall, they represent a confirmation of Piaget-Bruner, although there are some important differences in detail which call for a comment and, perhaps, for some extension of the basic theory.

GRAPH 3

Product tasks developmentally by sample and years of schooling % success in each task



Perhaps the most immediate observation is the parallelism of the curves of all three school groups on all tasks except formal operations. It seems to us apparent that, although all the other four skills are eventually attained by all children, schooling makes a considerable difference to age of achievement—and this difference is accentuated if the schooling is in the child's vernacular or, alternatively, in the language of the culture in which he is living. Graphs 3b, 3c and 3d exemplify this hypothesis most clearly. As the task becomes more difficult the slopes of the development curves become much steeper for the New South Wales group than for the migrant group, the curve for which, in turn, is steeper than for the PNG school children. Put another way, the differences between the groups become greater with difficulty of task and increasing number of years of schooling.

Two further points need comment : the overall developmental performance of the PNG village children and the failure of any child in PNG to solve the formal operations task.

Since there is evidence of a developmental trend among village children in the three easiest tasks we are tempted to advance a cultural lag hypothesis: that is, we would suggest that, in the somewhat limited cultures (in western terms) of PNG villages, there are few opportunities for children to face situations which facilitate emergence of the conservation type of behaviour and hence there is delay; the fact that matched children from the same village cultures, but with school experience, do demonstrate these abilities with a close developmental trend predictable from Piaget's work, is support for this viewpoint. Genetically the potential exists, but the appropriate environment must also exist for the behaviour to manifest itself. The curve for conservation of length needs special comment. Very few PNG village children were able to demonstrate the behaviour or, in Piagetian terms, to say why; the proportion of success fell, if anything, with age. We are inclined to account for this in language/cultural terms. The general concept of length is difficult to express in some of the languages of our PNG samples and we may have failed to get the idea across. Certainly, none of the languages of our sample groups has a unit of length: distance, for example, is given in terms of time.

Strength is added to this hypothesis about the relation between language/culture and performance on the product tasks by some of the more detailed data on Papua-New Guinea, where the *specific* language spoken as a vernacular has a significant bearing on the achievement of conservation of quantity. There are significant differences among the linguistic groups in the proportions of children at each ' age ' who are able to perform the task successfully. Nor is this purely a problem of communication in the sense that children in one language area have instruction more effectively conveyed to them than those in another. Had this been so, we would expect a similar difference on all tasks—as is not so. The alternative hypothesis (which we are currently investigating in depth) is that terms for the concept of quantity and its conservation do not exist in some PNG languages in the same way that they do in western societies.

The formal operations curves call for special comment. Among both the New South Wales samples there is the predicted developmental trend although the migrant development is much slower than that among children speaking English as a first language at home. The proportion (·50+) of the New South Wales sample able to solve this problem successfully, on Piaget's criteria, is much the same as that among Swiss, American or English children. Apparently, there is some kind of lag imposed on bilingual children when tested in their second language.

The PNG situation is more puzzling. No child in PNG was able to succeed in solving the formal operations problem. It is possible that this was due entirely to a failure to communicate; the problem was, in cultural terms, so far outside children's experience that they were unable to understand the task. This issue is taken up below but it is worth pointing out here that *every* child, in this sample, *was* able to understand and solve the complex cognitive tasks of the button board. Other hypotheses are possible : for example, that the capacity involved in formal operations develops later, for one reason or another, among PNG children than among western children. (This is at present being tested with secondary school age children in Papua-New Guinea.) Such an explanation would, in itself, be open to a number of interpretations , there may be a genetic link; there may be something in the language-culture which inhibits the development of cognitive thinking of this kind—such as, for example, an incapacity *in the language* to express the negative instance.

We are indebted to Professor J. J. Goodnow for an alternative complementary interpretation. She suggests that the product tasks may divide into three groups in terms of performance :

(*a*) Conservation of length and conservation of quantity, where there is gain in performance with age or years of schooling, except in the village group where probability of success tends to fall with increasing age. That is, schooling is a necessary condition for correct performance.

(*b*) Matrix height and matrix reverse, in which all groups, including the PNG village children, have greater probability of correct response with increasing age. That is, schooling is not a necessary condition for success.

(*c*) Formal operations, in which no child in either of the PNG groups succeeds, but there is an increasing probability of success with age in both the New South Wales groups. That is, schooling may be a necessary condition, but it is not a sufficient condition for success.

This will bear further investigation. It should be possible to devise a series of cognitive tasks in which schooling as a condition for success in cognitive tasks could be investigated.

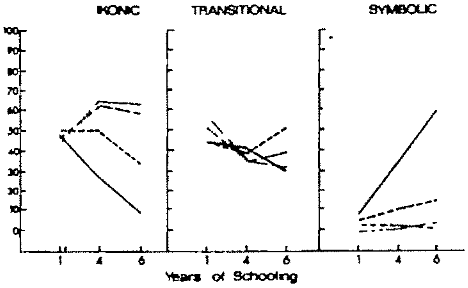
The developmental curves for the process tasks are intriguing. Graphs 4a and 4b are concerned with the two button board problems and 4c and 4d with the developmental trends on the equivalence tasks. It is immediately apparent that the data on which we commented earlier are confirmed by the developmental trends. Button board 6 is much more difficult than button board 1, and there is a correspondingly greater tendency in all groups to use the ikonic instead of the transitional or symbolic mode in solving the problem. Similarly, it is apparently easier to classify pictures than words and there is a corresponding increase in the use of perceptible or functional modes rather than the nominal when classifying words.

Of much more interest, and presumably more importance, are the differential tendencies to use ikonic rather than transitional or symbolic and to prefer perceptible to functional or nominal among the four sample groups. We begin by looking at the button board problems. It would appear that with increasing age New South Wales children are much less likely to use the ikonic mode and more likely to use transitional or symbolic strategies. Indeed, by the time they have had six years of schooling and are 10 or 11 years of age, very few children indeed still employ the ikonic mode to solve this relatively easy problem. The curve for the migrant children of New South Wales is parallel with this in terms of decrease in the use of the ikonic mode, although, even at the sixth year of schooling level, more children from the migrant group than from the ordinary New South Wales group are still using the ikonic mode. The curve for use of the symbolic, however, is much less steep. That is to say, the migrant children are much more likely still to be in the transitional stage in the fourth and sixth years of schooling. The New Guinea curves are quite different. Among these children, there is, in fact, an increasing use of the ikonic mode for solution of the easy button board 1 problem with years of schooling of age. It is true that some children, both village and school, use the transitional mode, but practically no child uses symbolic methods of attack on this problem. Attention should also be drawn to the similarity between the bilingual migrant and PNG school groups in the ways in which they deviate from the NSW group and the PNG village groups, respectively.

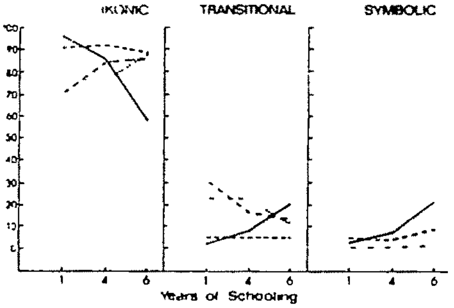
GRAPH 4

Process tasks developmentally by sample, years of schooling, and strategy % using each strategy

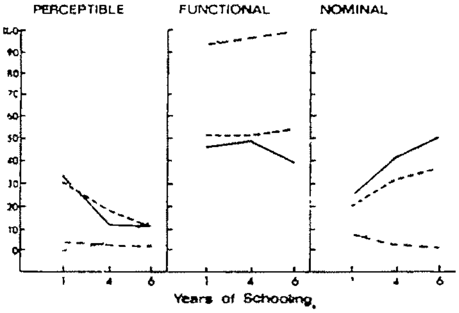
(a) Button Board 1



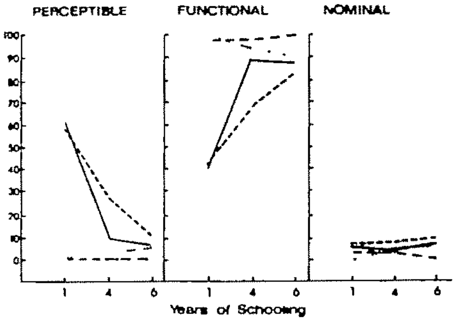
(b) Button board 6



(c) Photographs Bases



(d) Words Bases



—— N S W
- - - Migrants
N G School
- - N G. Village

When we turn to the more difficult button board 6, the trends become even more pronounced. There is, surely, a regression, as has been noted above, to use of the ikonic mode, even among the New South Wales children, but this trend decreases considerably with years of schooling. The migrant children, like New Guinea children, tend to use the ikonic mode more, rather than less, to solve this more difficult problem as they get older. Very few migrant children use the transitional mode and similarly the proportion using the symbolic mode is small. As far as the New Guinea children are concerned, none of them used the symbolic mode to solve the button board 6 problem. It must be emphasised that every child in this sample was able to solve the problem in the product sense. What is different is the mode in which they attacked it. It would appear that with increasing difficulty of task there is more likelihood of school children behaving in the same way as their age-mates and culture-mates from the same village.

We may now look at the equivalence tasks. It is important in considering these to recall that Olver and Hornsby postulate a hierarchy from perceptible through functional to nominal. That is to say, they contend that, developmentally, children tend to classify objects or words in perceptible terms first, then to move on to a functional base of classification and from this to a nominal. This would certainly appear to be true with the western children in our sample, but it certainly is not true of New Guinea children. If we look first at the classification task based on the photographs of objects, it is clear that practically no New Guinea child, even at the earliest of ages in our sample, used a perceptible base for classifying the objects presented. Almost to a child, they used the functional basis of classification at the earliest of levels. The school children tended to decrease in the use of functional mode and to increase in the use of either the perceptible or the nominal with increasing age. The village children, however, used the functional mode from the beginning and continued to use it equally successfully with increasing age. It will be recalled that both village and school children were tested in the vernacular in the first year of schooling or of age, whereas the school children were tested in English after the fourth or sixth year of schooling.

The New South Wales children, both migrant and non-migrant, tended to use either the functional or the perceptible in much greater proportions than the New Guinea children in the first year of schooling, to move on to use of the functional in the fourth year and to begin to use the nominal in increasing proportions in the sixth year of schooling. It is a reasonable hypothesis on this data that the language-culture group in which the child grows up has a major effect on the way in which he tends to classify the world around him.

This tendency may be seen even more clearly in the data on classification of words. The New Guinea children, from the beginning, classify the nouns in their language in functional terms. Very few of them, school or village, use perceptible bases of classification at any age. Similarly, very few of them use nominal bases of classification even after six years of school. On the other hand, the New South Wales children, migrant and non-migrant alike, tend to use perceptible bases for classification at the early ages and increasingly functional bases with years of schooling. Few of them are able to use nominal bases by the end of their sixth year of exposure to the school system.

SOME COMMENTS

We suggested at the beginning of this paper that we were immediately concerned with :

(*a*) An examination of the validity of some of Piaget's and Bruner's findings in non-western cultures ;
(*b*) The relationship between the cognitive models developed by Piaget and by Bruner, and
(*c*) The implications for curriculum, teaching and learning of any ' new ' data we might discover.

In the current article we are not reporting on the third of these objectives, except to say that some changes have already been implemented in the schools of Papua-New Guinea as a direct result of our findings.

Turning now to the first two basic problems :

(*a*) *On our data.*

(i) the behaviours described and classified by both Piaget and Bruner were demonstrated to exist among Papua-New Guinea children, whether or not they had gone to school and among, also, New South Wales children, migrant and non-migrant. The exception to this statement is that the behaviours described by Piaget as formal operations, did not appear among any of the Papua-New Guinea children in our sample.

(ii) the order of appearance of what we have called product behaviours is the same in all our samples, although median ages of appearance differ from one group to another. The fact that formal operations did not appear among our Papua-New Guinea children does not invalidate this statement, since it is the highest point in the Piagetian hierarchy of cognitive skills. That is to say, we might postulate that if we had gone further up the age range formal operations type behaviour would have made its appearance in PNG.

(iii) Brunerian product-type tasks are much the same in their order of appearance as Piagetian product-type tasks.

(iv) The Brunerian process-type tasks present a somewhat different picture. It is important to distinguish between the scale which Bruner describes as ' enactive ikonic, symbolic ' and that which his colleagues, Olver and Hornsby, derived from the classification of equivalence material. It would appear that these two scales are measuring somewhat different things, although they are correlated. Given this, the New South Wales children and the migrant children (and it will be remembered that they are in the main western Europeans) behave in much the same way as did children in the American samples described by Bruner and his colleagues. However, in Papua-New Guinea the ikonic-transitional-symbolic process runs against a Brunerian hypothesis. In fact, in a personal communication, Professor Bruner describes these results as " stunning and counter intuitive. The cultural norm in Papua-New Guinea is plainly to handle problems such as these in ikonic mode. Indeed, school seems to reinforce this mode. The assumption so widely accepted that school increases symbolic activity by taking learning out of the context of action and use is, plainly, not true in New Guinea " (Bruner to Philp, 1972).

(v) A similar result appeared in the equivalence tasks. The children of Papua-New Guinea, in our age sample range at least, do not follow the predicted hierarchy ; they are essentially functional in their approach to classification problems. Some school children do begin to use the nominal mode in fourth and sixth grades when they are being tested *in English* on their strategies for classification of photographs. Even at the sixth grade they still work almost exclusively in the functional mode when classifying words.

(vi) With increasing difficulty of process-type tasks the Papua-New Guinea school children become more like the village children. On easier tasks they tend to approach the process skills of New South Wales children.

(vii) The migrant children fall between the New South Wales children and the Papua-New Guinea school children on most tasks, but they are much more like the New South Wales group, especially as difficulty increases. It is worth remembering that these migrant children are living essentially within the general culture in which the schools exist. It is true that many of their homes have a somewhat different culture, but the general milieu of the playground, of the streets and so on, is that of the school. This is not true of the school children in Papua-New Guinea.

It is clear that a great deal more intensive research is need on the relationship between process and product tasks and more fundamentally on the effect of school enforced bilingualism on both.

(*b*) *Relationship between models.*

We may very briefly, indeed, comment on relationship between the Piaget and the Bruner models. Both these models work for product-type tasks. That is to say, children in every culture in which we have worked do the same kinds of things as they do in the samples described by both these theorists. On the other hand, the Brunerian model does not work in all cultures for process-type tasks. We would suggest that this is because different languages process the world in different sorts of ways. This needs depth analysis. We are not, by any means, suggesting that Sapir and Whorf (Hoijer, 1954) were right.

We have not speculated, except in passing, on the theoretical implications of our findings. It is our view that we need to present more data before venturing on such a task, but the results to this point seemed of sufficient importance to warrant publication, even in the exiguous form in which we have presented them here.

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THE PENDULUM PROBLEM: PATTERNS OF PERFORMANCE DEFINING DEVELOPMENTAL STAGES

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SUMMARY. Performance on Inhelder and Piaget's pendulum problem was obtained as a validating measure in a study of the transition from concrete to formal thinking. The sample consisted of 236 children aged from 10 to 14 years. A detailed scoring procedure was devised, which distinguished method from content aspects of performance on the problem and which allows categorisation of each child into one of nine developmental stages. Quantitative performance scores were also derived.

Overall level of performance on the pendulum problem is strongly related to age, but not to sex or to school attended. In general, the results support Inhelder and Piaget's account of the transition from concrete to formal thinking. However, a specific problem, for their theory, arises from the relationship between method and content aspects of performance in the early formal operational stage (IIIA). This problem is discussed in detail and attention is drawn to the effects of a child's expectations on his performance.

INTRODUCTION

PIAGET'S (1928, 1932) early conception of the nature of concrete and formal operational thought has been supported by the more recent work of Inhelder and Piaget (1958) and by other studies using tasks described in the later book (Lovell, 1961; Jackson, 1965; Pumfrey, 1968; Dale, 1970; Neimark, 1970; Bart, 1971).

Many problems exist, however, for the measurement of formal operational thought. The criteria established by Inhelder and Piaget (1958) for the assessment of performance on their tasks provide only an intuitive understanding of the details to be expected in practice. In general, those who have developed scoring systems based on the original ideas have not published details. The first purpose of the present paper is to provide a detailed scoring system for performance on one of their tasks, the pendulum problem. In addition, it reports data obtained from a sample of 236 Canberra school children and investigates a number of aspects of their performance.

SUBJECTS

The pendulum problem was employed in a larger study (Somerville, 1970) as a means of validating a new task designed to reveal differences between concrete operational and formal operational thought.

The total sample consisted of five age groups which were designated 10, 11, 12, 13 and 14-year-olds. The children were drawn from two government secondary schools in Canberra (13 and 14-year-olds) and from the two major government primary schools feeding those secondary schools (10, 11 and 12-year-olds). The group referred to as 10-year-olds was aged 9 years 11 months to 10 years 5 months, inclusive, at the time of testing; and similarly for the other four age groups.

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* The work reported here was carried out while the author was at the Australian National University

Children to be tested, in each age group, were chosen by proportional sampling from a stratified bivariate distribution of all those falling in an age range as indicated above. The bivariate distributions were based on the following two variables :

(1) raw score on the Standard Progressive Matrices (ACER 1966) :

(2) mark in a recent school mathematics examination. Separate distributions were made for each school, since the comparability of mathematics marks could not be assumed ; and only children in the same year at school were included in the same distribution. The proportions sampled were such as to give a total of 48 for each age group, with the restriction that girls and boys should be chosen with equal frequency from each of the cells. Four of the 12-year-olds were subsequently discarded because of inaudible tape-recordings.

METHOD

The Task.

The pendulum problem is one of a number, embodying physical laws, which Inhelder and Piaget (1958) have used to examine the stages of concrete and formal operational thought. In this problem the child experiments with strings of different lengths, weights, amplitudes of oscillation and strengths of impetus in order to discover what determines the frequency of oscillation of a pendulum. In the present study, the amplitude of oscillation and strength of impetus are treated as the same variable, since all children tested perceived the latter as having an effect on and through the former. This would probably not be the case with younger children.

The level of performance of a child is assessed by observing both the method of experimentation he employs and the content of conclusions he reaches. Inhelder and Piaget (1958) claim that, in order to draw valid conclusions, a child must interpret his observations in terms of two of the 16 binary propositions, namely equivalence and complete affirmation. In their account, the former is the logical basis of an understanding that the length of the string is inversely related to the frequency of oscillation ; the latter of the understanding that each of the other factors is irrelevant. The situation is complicated by the fact that the role of the length of the string may be discovered by the concrete operational method of establishing a correspondence between two ordered variables. Hence, to determine the stage of operational thought achieved by the child, it is necessary to take into account his experimentation with the materials, his conclusions and the manner in which the latter are derived from the former.

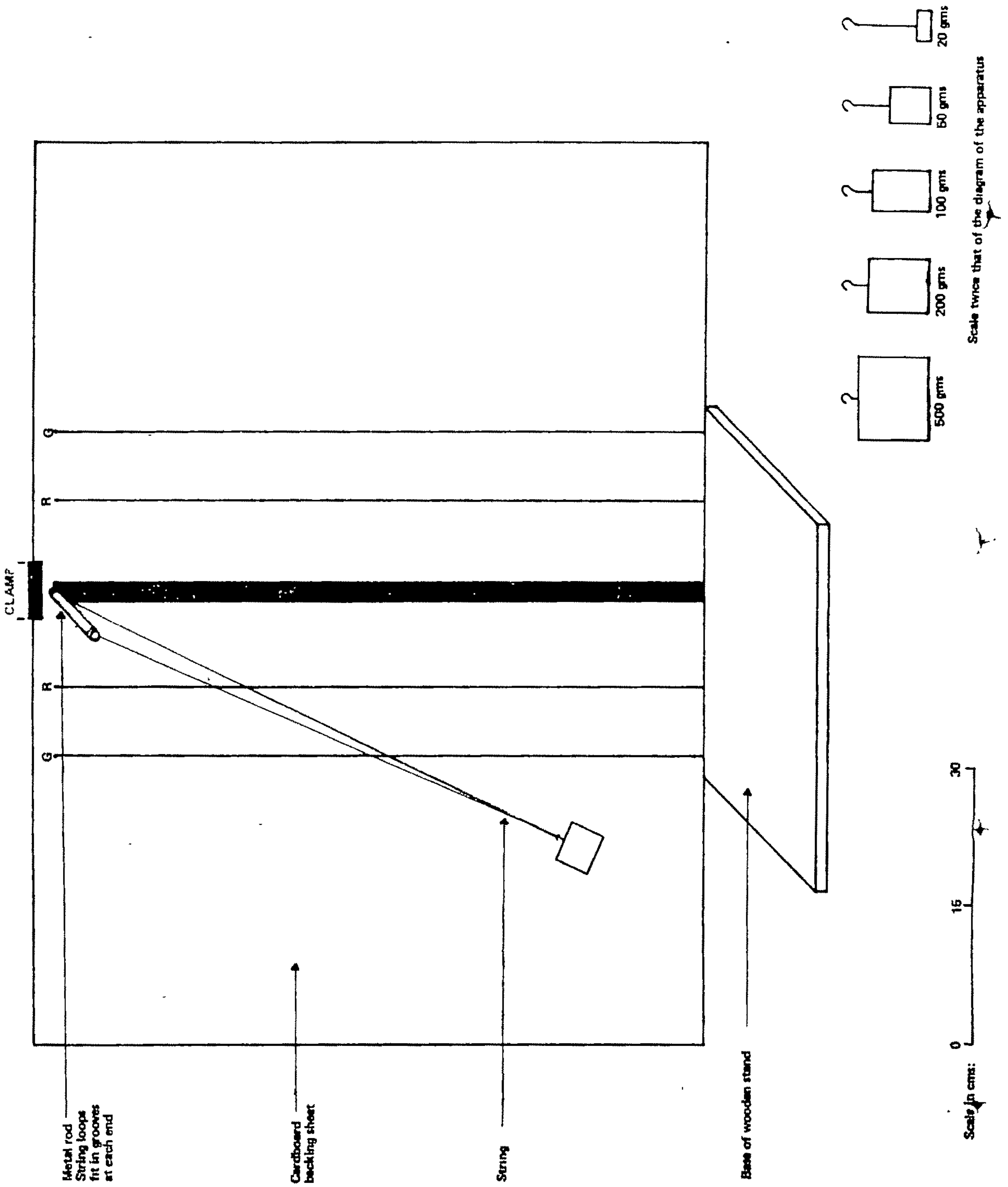
In the present study, presentation of the task and the method of questioning were based as closely as possible on the work of the original authors. Children were tested individually by one of two testers and their performances recorded in detail. A step by step account of their experimentation with the materials was made on a record sheet and this was interpreted later in conjunction with a tape-recording of all remarks made by the tester and the child.

The Apparatus.

Figure 1 shows the apparatus (drawn to scale) used to test subjects on the pendulum problem. Weights were made of brass and the three pendulum lengths (string length plus length of weight attached) were 21·6, 43·2 and 64·8 cm. The figure shows the 500gm weight on the long string. Pairs of red and green lines (labelled R and G, respectively) were drawn on either side of the centre black line to mark two amplitudes of oscillation.

FIGURE 1

Apparatus Used for Testing on the Pendulum Problem.



Instructions.

The child was shown how to attach a string and a weight to the apparatus in order to make a pendulum and told that the task was to find out what would make the ' clock ' tick more slowly or more quickly. It was suggested to the child that the ' speed of ticking ' could be judged by noticing how often the weight crossed the black line in the centre of the board.

The instructions emphasised that it was not a test situation, in which the child might feel under pressure to obtain the correct answer as quickly as possible, but that he was free to take his time and to try out whatever he liked. He was encouraged to talk aloud while he worked and told that a record was being kept of the things he did and said.

The general types of questioning used when the child had begun to work were as follows:

If no reason was offered for manipulations, or no comment on the result, the child was prompted by: " What are you finding out now? ", " What did you see? " etc.

If an effect was implicitly or explicitly attributed to some variable(s), e.g., " It's going faster " or "It's the weight", the tester probed for more precise formulations by saying: "How would you make it go faster still? ", " What exactly have you found out about the weight? " etc.

If the child neglected to examine some variable(s), the tester asked: " Is that all? ", " Is anything else important? ", if necessary asking specifically (e.g.) " What about the weight? "

The child was not told whether his conclusions were correct. Experimentation and questioning continued until each of the three relevant variables had been considered. At this point, the child was asked to imagine that a friend had arrived and was asking to be shown all the things he had discovered about the pendulum. He was asked to tell (and if necessary show) the tester what the best demonstration would be. Some prompting was given if he omitted to mention some variable(s).

SCORING PROCEDURE

The scoring system devised is more formalised and, therefore, less flexible than that of the original authors, but was designed to be consistent with their account of the transition from concrete to formal thought. After studying a number of the records of performance, it was decided to specify several aspects on which each child could be rated successful; successful sometimes or with difficulty; or unsuccessful (denoted by +, O, — respectively). These aspects of performance divide into those concerned with the method of experimentation used by the child and those concerned with the content of the conclusions reached. An indication of how the ratings were made is given below.

Aspects of Performance Relating to the Method of Experimentation.

(1) *Some attempt to hold other variables constant.*
  + Awareness throughout of the need to control other variables when examining the effects of one (or more) in particular;
  O This awareness only rarely;
  — No attention to other variables when considering the effects of one (or more).

(2) *Changes only one variable to examine an effect* (success on aspect (1) above prerequisite).

+ All variables except one kept constant in consecutive tests throughout ;
O Above procedure used sometimes but not seen as essential ;
— Two or more variables changed at a time.

(3) *Changes variable(s) correctly to test as intended.*

+ Variable(s) changed consistently with stated intentions ;
O Some confusion about which variable(s) to change ;
— Behaviour such as changing the weight to examine the effect of the length of the string.

(4) *Makes inferences about appropriate variable(s).*

+ Conclusions (not necessarily correct) expressed pertain to the variable(s) manipulated ;
O Conclusions not always appropriate to the experimental manipulations ;
— Conclusions seldom appropriate to the experimental manipulations.

(5) *Makes some untested inferences.*

+ Able to generalise conclusions to other values of variables without testing ;
O Able to predict results for other values of variables, but tests to make sure ;
— Unwilling to make predictions about any values of variables not seen.

(6) *Overall efficiency of procedures* (success on aspect (5) above prerequisite).

+ Extremely efficient—near maximum inference from minimum number of tests in own work and/or demonstration to friend ;
O Moderately efficient—relies to some extent on inference ;
— Inefficient—little or no tendency to eliminate unnecessary tests.

Aspects of Performance Relating to the Content of Conclusions Reached.

Ratings of +, O, or — were made on the following two aspects of conclusions reached :

(1) *Ordering of effects* of each variable (whether or not the effects were correct) ;

(2) *Correct effects* of each variable.

These two ratings were made for each of the three variables:

St—the length of the string ;
Wt—the size of the weight ;
Ht—the amplitude of oscillation, indicated by the height of the dropping point.

A rating of + indicates, on the first aspect, *successful ordering* and, on the second, *correct statement* of the effect of a variable ; a rating of O indicates the *same success but with a good deal of wavering or confusion* ; a rating of — indicates, on the first aspect, *failure to order* and, on the second, *failure to state the correct effect* of a variable.

It should be noted that the ordering refers to the effect of a variable, not to the values of the variable itself ; for example, if the medium string is said to give a slower rate of oscillation than the short string, the rate of oscillation for the long string should be said to be slower still.

PATTERNS OF PERFORMANCE RATINGS OBTAINED

The method described above yields a total of six ratings (two on each of three variables) concerned with the content of conclusions reached and a further six concerned with the method of experimentation, for each child. Patterns of performance ratings on the 12 aspects were grouped together to define stages of development as measured by the pendulum problem. It was possible to add several transitional categories to the stages described by Inhelder and Piaget (1958), so that nine categories are defined altogether. This compares with the number used by Lovell (1961) to categorise the performance on a number of formal operational tasks, including the pendulum problem. Every pattern of ratings obtained in the present study is included in the account which follows (Table 1).

The description of stages above is too detailed to give an adequate indication of the qualitative differences which exist between them. The important differences on which the classifications are based may be summarised as follows :

Stage IIIB (including IIIB and III B ? A).

The child has the necessary operations to understand an equivalence relationship (between the length of string and the frequency of oscillation) and the exclusion of a factor (either the size of the weight, or the height of the dropping point, or both) and also investigates these relationships in a rigorous manner (varying only one at a time, and mostly doing so appropriately). He is also able to generalise findings in one set of conditions to others which are appropriately similar.

Stage IIIA (including III A ? B, IIIA and IIIA ? IIB).

The child has serious difficulty *either* with the understanding of the exclusion of a factor (the size of the weight, or the height of the dropping point, or both) *or* with the appropriate experimental manipulation of variables. Weakness (but not complete failure) in both aspects may also characterise this stage. The achievement of this stage is an ability to discover the equivalence relationship between the length of the string and the frequency of oscillation, with some other indication that this achievement is no longer reached by the concrete operational method of establishing correspondences between ordered variables. This indication comes either from the method of investigation used, or from the fact that the exclusion of a factor is understood. In either case, it appears that the child now understands that the equivalence relationship is not the only one possible and that he needs to envisage or to investigate others as well. He has only the beginnings of the operational structure required for this, however, and is liable to find one or other aspect of the task too difficult.

Stage IIB (including IIB ? IIIA, IIB and IIB ? A).

The child at this stage understands that there are a number of variables involved in the situation. He is able to order the values of each and expects that the effects will correspond to this ordering. He may not be completely sure of the ordering of *effects*, particularly in the case of the size of the weight, and may decide, for instance, that the 100gm weight is ' just right ' while those smaller and larger than it all go too slowly. It does not seem, however, that this failure to order the effects correctly is a failure which would class the child as pre-operational. It seems more likely that he has an *expected order* for the effects of weight, and that when this is not found, he distorts his observations either in the direction of his expectation, or toward some other compromise solution. It is not a failure to seriate as such, which would be implied by a classification of the performance as ' pre-operational.'

TABLE 1

PATTERNS OF PERFORMANCE RATINGS DEFINING NINE DEVELOPMENTAL STAGES ON THE PENDULUM PROBLEM.

Stage and Description of Achievements		Content						Method					
		Ordering			Correct Effect			Some attempt to hold constant	Varies only one to make a test	Varies correctly to test as intended	Infers about correct variable (s)	Makes some untested inference	Infers maximum from the minimum
		St.	Wt.	Ht.	St.	Wt.	Ht.						
IIIB. Finds correct effect of each factor (possibly with difficulty over one exclusion—see (*b*)) and is sound on all aspects of method—may not infer from minimum testing, however must show some untested inference.	(*a*)	+	+	+	+	+	+	+	+	+	+	+	+ or O or –
	(*b*)	+	+	+	+	(O +) or (+ O)		+	+	+	+	+	+ or O
IIIB? A. Some failure in one aspect of performance—perhaps fails to exclude one factor, but method is good and includes some untested inference (*c*); perhaps some faults in method but succeeds in finding all the correct effects of factors (*a*) Some untested inference is required unless the performance is otherwise faultless. (*b*)	(*a*)	+	+	+	+	+ or O	+ or O	+	+	+	O	O	–
	(*b*)	+	+	+	+	+	+	+	+	+	+	–	–
	(*c*)	+	+	+	+	(– +) or (+ –)		+	+	+	+ or O	+ or O	–
III A ? B. (*a*) and (*b*)—Finds exclusion very difficult and method, although mostly sound, shows no untested inferences or (*c*) although failing completely to exclude, has excellent method of investigation.	(*a*)	+	+	+	+	O	O	+	+	+	+ or O	–	–
	(*b*)	+	+	+	+	(+ –) or (– +)		+	+	+	+	–	–
	(*c*)	+	+	+	+	–	–	+	+	+	+	+	+
IIIA (*a*) Fails to exclude weight and height (perhaps because of uncertain ordering) but method has few faults and may show some untested inferences, or (*b*) excludes one of weight and height with difficulty and has some shaky aspect to method and no untested inferences, or (*c*) excludes both weight and height with difficulty, but method is shaky throughout, although may show some untested inferences.	(*a*)	+	+ or O	+ or O	+	–	–	+	+	+	+ or O	O	–
	(*b*)	+	+	+	+	(O –) or (– O)		+	+	+	O	–	–
	(*c*)	+	+	+	+	O	O	+	O	O	O	O or –	–

Stage and Description of Achievements		Content						Method					
		Ordering			Correct Effect			Some attempt to hold constant	Varies only one to make a test	Varies correctly to test as intended	Infers about correct variable (s)	Makes some untested inference	Infers maximum from the minimum
		St.	Wt.	Ht.	St.	Wt.	Ht.						
III A? IIB (*a*) Fails to exclude weight and height (perhaps because of uncertain ordering) and method has one shaky point and no untested inferences, or (*b*) excludes only one of weight and height with difficulty and method is shaky throughout with no untested inferences, or (*c*) succeeds in finding correct effect of each factor, but only with difficulty for each one, and method also shows one shaky point, or (*d*) fails exclude weight and height and finds effect of string only with difficulty, but method has no shaky aspects although there is no untested inference.	(*a*)	+	+ or O	+ or O	+	—	—	+	(+ (O	+ +	O or +	— —	—) —)
	(*b*)	+	+	+	+	(O —) or (— O)		+	O	O	O	—	—
	(*c*)	+	+	+	O	O	O	+	(+ (O	+ +	— or +	— —	—) —)
	(*d*)	+	+	+	O	—	—	+	+	+	+	—	—
II B ? IIIA (*a*) Fails exclude weight and height (perhaps because of uncertain ordering) and method is weak throughout, but shows at least O on " varies only one to make a test," or (*b*) excludes only one of weight and height with difficulty and method is shaky showing either O or—on " varies only one to make a test," or (*c*) although one of weight and height is excluded, method is completely unacceptable throughout.	(*a*)	+	+ or O	+ or O	+	—	—	+	+ or O	O or —	O or —	—	—
	(*b*)	+	+	+	+	+ or O or —	— + orO	+	O or —	+ or O	+ or O	—	—
	(*c*)	+	+	+	+	(+ —) or (—+)		+	—	—	—	—	—

Stage and Description of Achievements	Content						Method					
	Ordering			Correct Effect			Some attempt to hold constant	Varies only one to make a test	Varies correctly to test as intended	Infers about correct variable (s)	Makes some untested inference	Infers maximum from the minimum
	St.	Wt.	Ht.	St.	Wt.	Ht.						
II B (*a*) Fails to exclude both weight and height (perhaps because of uncertain ordering) and fails in method at *least* to vary only one to make a test and possibly to vary and/or infer correctly as well, or (*b*) fails to find correct effect of string, although is able to exclude one of weight and height—and method shows failure on one of the two aspects " varies only one . . " and " varies and infers correctly "	(*a*) +	+ or O	+ or O	+	—	—	+	—	+ or O	+ or O	—	—
	(*b*) + or —	+	+	—	+ or O or —	— + or O	+	— or O	(+ or O (—	+ or O or —	— —	—) —)
II B ? A (*a*) Fails to exclude both weight and height (possibly because of uncertain ordering) and also has difficulty finding correct role for string ; method also fails either to vary only one, or to vary and infer correctly or (*b*) fails to find correct role for all three variables (and may also fail to order one or more) but method, although shaky, shows some ability to vary only one and vary and infer correctly.	(*a*) +	+	+	O	—	—	+	(— (+ or O	+ or O —	+ or O or —	— —	—) —)
	(*b*) + or O	+ or O	+ or O	—	—	—	+	O	O	O	—	—
II A ? B (*a*) Fails to exclude weight and height (perhaps because of uncertain ordering) and either fails or has difficulty finding correct effect of string—method also fails (or has O) to vary only one and to vary and infer correctly, or (*b*) fails to find correct effect of any variable and may be unable to order the effects as well—method in addition is extremely weak.	(*a*) +	+ or O	+ or O	O or —	—	—	+	O or —	—	—	—	—
	(*b*) + or O	+ or O	+ or O	—	—	—	O	(O (—	— O	— or —	— —	—) —)

It is quite common for a child at this stage to describe the correct relationship between length of string and frequency of oscillation. It is not understood as a formal, logical relationship, however, but 'observed' as a matter of empirical correspondences. The fact that there is a need to decide between a number of *possible* relationships is not understood by the child. He, therefore, does not carry out appropriate tests in a systematic manner and may not even know what the experiment he has performed can tell him.

The major conceptual problem which presents itself is that of understanding how a set of ordered weights can correspond to a set of equal frequencies of oscillation. Sometimes a child at this stage will say that the weight does not *seem* to make any difference, but the impression is always that he is sure that some sort of an effect is there and that something is wrong with his experimentation. He does not consider 'no effect' as one of the possible relationships.

Stage IIA (IIA ? B only).

In the present study, no clear cases of Stage IIA performance, as described by Inhelder and Piaget (1958), were obtained. Four children were classified as IIA ? B as they appeared to have great difficulty in seeing the situation in terms of the interrelationships between variables. The fact that they did not have difficulty in ordering the effects of weight, however, prevented their being classified as definitely in State IIA.

RELIABILITY OF RATINGS

Inter-rater reliability estimates were not obtained, but the performances of the 236 children were rated again, by the same experimenter, after an interval of six months. In the re-rating, the original tape-recordings were not heard again but were used in the form of transcriptions made (verbatim) on the record sheet at the time of the original ratings. The stage allocations of only 15 of the 236 children were different on the second occasion and in no case was the new allocation more than two categories away from the original, on the 9-category scale.

RELATIONSHIP OF PERFORMANCE TO OTHER VARIABLES

The relationship of performance on the pendulum problem, as measured by the nine stage categories, to age group is shown in Table 2. To test the significance of the association of performance with age, the nine categories were collapsed into three as follows:

Stage IIIB—comprising IIIB and IIIB ? A.
Stage IIIA—comprising IIIA ? B, IIIA and IIIA ? IIB.
Stage II—comprising IIB ? IIIA, IIB, IIB ? A and IIA ? B.

The value of chi-square obtained is 41·85, df=8, $P<\cdot 001$, and the contingency coefficient is 0·39. Using the same three categories, the difference between each possible pair of age groups was tested by chi-square and one (non-significant) result over-ruled in order to come to a consistent set of conclusions as to where the differences lie. This set of conclusions may be expressed by "$(10=11=12)<(13=14)$."

Within each age group, the relationship of sex to performance in the same categories was examined by chi-square. For the 11-year-old group, the relationship was significant (chi-square=10·78, df=2, $P<\cdot 01$), and indicated a superiority of boys over girls. In no other age group did this relationship reach significance. The relationship of school attended to performance was investigated in the same manner, but was not significant in any of the five age groups.

TABLE 2

AGE DISTRIBUTIONS OVER STAGES ON PENDULUM PROBLEM.

Stage Category	Age Group (years)					Total Sample
	10	11	12	13	14	
IIIB	2	6	6	9	12	35
IIIB ? A	2	2	5	11	15	35
IIIA ? B	5	10	9	3	0	27
IIIA	10	12	12	5	11	50
IIIA ? IIB	7	5	2	8	6	28
IIB ? IIIA	7	2	3	7	4	23
IIB	9	7	5	4	0	25
IIB ? A	4	2	2	1	0	9
IIA ? B	2	2	0	0	0	4
Total	48	48	44	48	48	236

QUANTITATIVE SCORING SYSTEM

To further the analysis of results, it was decided to develop quantitative scores from the performance ratings. Four scores were derived as follows :

I. *Pendulum Content Score.*

Taking the children's conclusions about the three variables involved (string length, weight, and the height of dropping point), it was possible to ask firstly whether a correct *ordering* of the effects of a variable had been achieved, and secondly whether or not the effect ascribed to a variable was the *correct* one. A system of rating the performance of a child as —, O, or + on each of these aspects has been described. If these ratings are now changed to scores of 0, 1 and 2, respectively, then the total score on the six aspects (out of a possible 12) is the *Pendulum Content Score.*

II. *Pendulum Method Score.*

The second aspect of performance for which ratings have been described is the child's method of investigation of the problem. Six relatively independent items relating to the method used were rated —, O, or +, as for the content aspects. These ratings may be transformed into scores of 0, 1 and 2 in a similar way to that for the *Pendulum Content Score.* Again, a total score (out of a possible 12) is obtained, which is referred to as the *Pendulum Method Score.*

III. *Pendulum Total Score.*

The sum of the Pendulum Content and Pendulum Method Scores gives the Pendulum Total Score, out of a possible 24.

IV. *Pendulum Stage Score.*

It is also possible to assign the scores 1 to 9 to the substages of performance identified on the Pendulum Problem (score 1 for Stage IIA ? B through to score 9 for Stage IIIB).

RESULTS

The means and standard deviations of scores I, II, III and IV above for each age group separately, for two combined age groups (10, 11 and 12 years combined; and 13 and 14 combined) and for the total sample are shown in Table 3.

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR FOUR QUANTITATIVE SCORES.

Score		Age Group (years)					Combined Age Groups		Total Sample
		10	11	12	13	14	10, 11, 12	13, 14	
Pendulum I Content	$\bar{X}$	8·15	8·92	9·30	9·46	9·83	8·77	9·65	9·13
	s	1·56	1·91	1·56	1·90	1·69	1·74	1·80	1·82
Pendulum II Method	$\bar{X}$	6·46	7·23	7·70	6·90	8·44	7·11	7·67	7·34
	s	1·90	1·80	2·15	2·63	2·48	2·00	2·66	2·30
Pendulum III Total	$\bar{X}$	14·60	16·15	17·00	16·35	18·23	15·89	17·29	16·46
	s	3·15	3·45	3·35	4·10	3·88	3·44	4·08	3·77
Pendulum IV Stage	$\bar{X}$	4·77	5·67	6·14	6·29	7·08	5·51	6·69	5·99
	s	2·00	2·18	2·01	2·12	1·69	2·13	1·95	2·13
	N	48	48	44	48	48	140	96	236

One-way analyses of variance were performed to test the significance of the differences between mean performances of the five age groups. Table 4 shows the values of F obtained, each of which is significant at the ·001 level, and the sets of conclusions reached, by the application of t-tests to pairs of means, about the location of differences.

TABLE 4

RESULTS OF ANALYSES OF VARIANCE.

Score	df	F	p	Conclusions about differences
I Pendulum Content	4,235	6·63	$<$·001	$\mu_{10} < (\mu_{11} = \mu_{12} = \mu_{13}) < \mu_{14}$
II Pendulum Method	4,235	5·81	$<$·001	$(\mu_{10} = \mu_{11} = \mu_{13}) < (\mu_{12} = \mu_{14})$
III Pendulum Total	4,235	6·55	$<$·001	$\mu_{10} < (\mu_{11} = \mu_{12} = \mu_{13}) < \mu_{14}$
IV Pendulum Stage	4,235	8·04	$<$·001	$\mu_{10} < (\mu_{11} = \mu_{12} = \mu_{13}) < \mu_{14}$

Product-moment correlations were computed between scores I and II and between scores III and IV. These were obtained separately for each age group, so that the improvement of both scores with age would not result in spuriously high values. The values of the coefficients, each of which differs from zero at the ·001 level, are shown in Table 5.

TABLE 5

CORRELATIONS BETWEEN TWO PAIRS OF SCORES.

Age Group	N	Product-moment Correlations between scores	
		I and II	III and IV
10 years	48	+·652	+·900
11 years	48	+·722	+·941
12 years	44	+·614	+·923
13 years	48	+·632	+·950
14 years	48	+·757	+·926

Correlations of the order obtained between the Content and Method scores justify their summation to give a Total score. It may be concluded, tentatively, that they measure some common and some unique aspects of performance. The high correlations between the Total and Stage scores support the conclusion that they are equivalent indices of overall performance on the problem.

SUMMARY AND DISCUSSION

A set of nine developmental stages has been described, to which children may reliably be allocated on the basis of their performance on Inhelder and Piaget's (1958) pendulum problem. The scoring procedure distinguishes aspects of performance concerned with the method of investigation used from those concerned with the content of conclusions reached by the child. However, these two aspects are combined to achieve the overall allocation to stages.

The details of the scoring system show that the concrete operational child structures the problem in terms of classed and ordered objects and events and may discover the role of the length of the string by establishing a correspondence between two orderings. His experimentation consists of a series of uncontrolled observations. He speaks of the " long string " which is " slow," the " medium string " which is " medium," and the " short string " which is " fast." By contrast, the formal operational child structures the problem in terms of variables and speaks of " the length of the string," " a change in the weight," and " an increase in the rate of ticking." His experimentation is designed to test whether each of the independent variables has an effect and he is prepared to reach any of the possible conclusions (including " no effect "). His conclusions are expressed in the form " the shorter the string, the faster the rate of ticking."

On a general level, the results obtained in this study provide support for Inhelder and Piaget's (1958) account of concrete and formal operational levels of performance on the pendulum problem. Most of the behaviours which Inhelder and Piaget described as typical of different developmental stages have been observed here ; and there is evidence of a fundamental difference between the concrete and formal operational conceptions of the problem. Because the data is cross-sectional over a number of age groups it is not possible to discuss the average age and speed of transition from concrete to formal thinking. It is clear, however, from the wide spread of each age group over categories in Table 2, that there must be marked individual differences in the time, at least, of transition.

However, a number of difficulties are raised, by the present study, for the account of this developmental transition. These lie in the relationship between method and content aspects of performance and concern the early stage of formal thought (IIIA) and two transitional stages (IIIA ? B and IIIA ? IIB).

Inhelder and Piaget see children in the early formal operational stage as having a " formal logic in the process of formation . . . superior to their experimental capacity." They hold that the children's logic has " not yet adequately structured their method of proof " (p. 75). In support of this argument, they observe that children at this stage are able to reason correctly if presented with a properly controlled demonstration of the effects of variables, but are unable to devise such a demonstration for themselves. There is no suggestion that the child might have difficulty with the comprehension of experimental effects, still less that he might distort what he observes because he does not expect or cannot interpret it. However, it is difficulties of this kind which have led Lovell (1961) and Jackson (1965) to observe that there are important deviations from the behaviours described by the original authors ; and which also give rise to the problems of interpretation in the present study.

Lovell reports that he " . . . found subjects would serially order particular variables but draw the wrong conclusions. Perception seemed to be at fault in these instances " (p. 150). This corresponds with a difficulty encountered in devising the stage categories, namely, that an adequate method of experimentation did not always ensure that the correct conclusions would be drawn. Patterns of performance ratings which were classed in Stage categories IIIA ? B, IIIA and IIIA ? IIB are all characterised by a method of experimentation which is in advance of the child's ability to draw logical conclusions. Table 2 shows that the total numbers of children in these categories are 27, 50 and 28, respectively, whereas no such cases were apparently obtained by Inhelder and Piaget.

It has already been suggested that the performance characteristic of these children arises from the fact that their observations do not correspond with the types of relationships they expect to find. Inhelder and Piaget describe inaccurate observations of events as characteristic of the child in the much earlier pre-operational stage. Lovell has attributed inconsistencies in performance to problems of perception. It is argued here, however, that inaccurate observations provide the child with a way of dealing with uninterpretable data obtained either through inadequate (as in Stage IIB) or through adequate (as in Stage IIIA) experimentation.

Other investigators have drawn attention to similar, though not identical, problems for the theory. Lunzer (1965) claimed that children up to the age of 13 or 14 years " . . . may be led to understand the superiority of the proof by the ' method of all other things being equal,' but they do not adopt it spontaneously " (p. 24). The present investigation suggests that some children spontaneously use a controlled method of experimentation without an ability to interpret the results. Both kinds of discrepancy point to the relative independence of the two aspects of performance. Thus, it is possible to argue that Inhelder and Piaget's (1958) account of the transition from concrete to formal thinking is inadequate where the early stage of formal operations is concerned ; that, rather than all children in Stage IIIA having a logic in advance of their method of experimentation, the reverse may be true for some children at least.

The suggestion that the relationship between the two aspects of performance is not as straightforward as in Inhelder and Piaget's account is supported in a more general way by the data in Tables 3 and 4. Whereas the Content and Stage scores improve in a uniform way with age, there is a different trend for the Method score. The Method score shows a significant improvement from 11 to 12 years and then a significant drop from 12 to 13, followed by another significant improvement to the 14-year-old level. This suggests the possibility that the child's method of experimentation, in particular, is subject to the influence of environmental factors. Taking the argument further, it might be anticipated that if a child were given training in methods of experimentation, without there being a concomitant advance in his understanding of the possible logical relationships between variables, he might display precisely the kind of difficulties with ' expectations ' on the pendulum problem, discussed above. A recent study (Siegler, Liebert and Liebert, 1973) suggests that performance on this problem is improved by direct conceptual training and/or practice on analogous problems, but not by practice in the use of a stop-watch. Their method of assessment of performance may not, however, be comparable with that of Inhelder and Piaget (1958) or the present study. More detailed scoring systems, such as that outlined here, may be necessary for a thorough investigation of interrelated aspects of performance.

There are important implications of these results and considerations for the theory of the nature of formal thought and for the concept of the 16 binary operations as a structured whole, in particular. Inhelder and Piaget suggest that certain of the 16 binary operations are easier for a child to discover than others. In fact, in the pendulum problem, as in several others, the transition from the early formal substage (IIIA) to the later (IIIB) is marked by the understanding of a new type of logical relationship, more difficult than that understood in the earlier substage. For the pendulum problem, the easier relationship is that of equivalence (reciprocal implication) and the harder one exclusion (complete affirmation). The authors claim that it is easier for the child to deal with the operations " . . . which state that which is and establish true implications . . . (than) those which exclude that which is not and deny the false implications " (Inhelder and Piaget, 1958, p. 75). Thus, it would seem that the stage of formal thought is likely to exhibit ' décalages ' between tasks and also between the understanding of different logical relationships within a task. Pinard and Laurendeau (1969) have stressed the danger which an over-ready acceptance of these ' décalages ' must hold for a stage theory and, in particular, for the notion of ' structures d'ensemble.'

A compromise position can be suggested. The fundamental change taking place in the transition to formal operations must still be seen as the understanding that any given empirical relationship between variables is only one of the types of relationship which could, theoretically, exist. It may not be necessary to claim, however, that all 16 types of binary relationship are equally familiar to the adolescent or equally easy for him to identify in practice. The stage of formal operations may begin, for example, with the distinction of equivalence from ' other relationships ' and the others may then become progressively differentiated from one another. It is possible to argue that the relationship of equivalence is understood first because it is more closely related than any other to the type of correspondence between orderings which the child was able to establish at the stage of concrete operations.

Further, it can be suggested that in the early stage of formal operational thought a child may expect all logical relationships to be of this (equivalence) form, or may find any other form of relationship uninterpretable. Thus, he does not need to experiment incorrectly in order to fail to exclude variables on the pendulum problem; his expectations can, in fact, lead to a distortion of observations in the direction of some comprehensible relationship.

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TRANSITION TO SECONDARY — AN EXPERIMENT IN A SCOTTISH COMPREHENSIVE SCHOOL

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SUMMARY. The attainments, attitudes, personality characteristics and friendship relations of three successive year groups of children (N=254, 252 and 234) were assessed towards the end of their first term in secondary school, the first group having transferred direct to the secondary school from their various primary schools whereas the other two groups had spent one year in a transition department. The children from the transition department were found to be better adjusted in the social and emotional domains than those who had not had this experience. These differences were more pronounced in the case of girls, children of average and low VRQ and children coming from small primary schools.

INTRODUCTION

THE work of Nisbet and Entwistle (1966, 1969) has shown that there are large individual differences in the physical, intellectual, social and emotional development of children which make it impossible to select any one age as the *correct* age for transfer from primary to secondary school. They have also provided statistical evidence, and written evidence from some of the children involved,* to show that a Hadow report type 'clean cut' between primary and secondary schooling was likely to have an adverse effect on the attainment and on the emotional adjustment of some children, especially those who were younger, less stable, or from a lower working class background. Nisbet and Entwistle also quote an example, Philip (1968), of how a relatively simple organisational change in the transfer arrangements significantly reduced the difficulties of early adjustment. Their conclusions were that the transition from primary to secondary education should extend over the whole period from age 10 to age 13 during which time there should be a gradual change in curriculum and style of teaching and that organisational efforts should be made to familiarise older primary school children with the secondary school to which they would soon be going.

At about the time the above research was published Banff Education Committee were concerned about the educational consequences of the opening of a large new comprehensive school in Banff which would draw pupils from a fairly wide area and from a considerable number of primary schools of varying size. In particular, they were worried about the effects of transfer on pupils coming from small rural primary schools, most of whom would previously have gone to smaller, three-year secondary schools in their own district. The Education Committee therefore decided, as an experiment, to start a transition department in Macduff (approximately two miles from Banff) to be attended by all those Primary 7 pupils (i.e., final year in primary school) who would eventually transfer to Banff Academy for their secondary education. This transition department, although physically separate, was to be run as a part of Banff Academy. During their year in the transition department the pupils would be gradually introduced to teachers from certain subjects (e.g., art and music) so that they would be more ready for the secondary specialist teaching situation in which they would have a different teacher for every subject. In addition, the pupils would be allocated to the houses they would join on entry to the secondary department and the teachers responsible for each house would make a series of familiarisation visits to the transition department. It was hoped that these moves towards a closer liaison between the primary situation and the secondary would lead to a lowering of anxiety and an improvement in attitudes to school at the time of transfer while at the same time having no deleterious effect on attainments in the basic subjects.

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* See also Murdoch (1966) and Plowden (1967).

Having decided to set up the transition department the Education Authority then approached the Educational Psychology Department of Aberdeen College of Education to ask for their help in attempting to assess the effect of the new system on the pupils' attainments, anxiety and attitudes. (Separate studies of the effects of the introduction of the transition department on the primary schools which had lost their most senior classes and on the local communities were to be carried out by the Director of Education.)

METHOD

Since the request for evaluation was made after the last group of non-transition pupils had started their P7 year, a comparative study of the attainments, attitudes, etc., before and after the completion of the year was not possible. It was decided, therefore, to adopt a cross-sectional approach and to test successive year groups towards the end of their first term in secondary school, the first group having directly transferred to the secondary school from their various primary schools in the traditional way and the other two groups having each spent one year in the transition department prior to transfer. From now on these groups will be referred to as D, T1 and T2, respectively. The cross-sectional approach, however, has certain drawbacks, the most important, in the case of this study, being the assumption that all three year groups start off with the same levels of attainments and attitudes, and that consequently any differences found between the groups at the end of the investigations are entirely attributable to the different P7 situations which they have experienced. Examination of the school records indicated that there were no important age differences between the groups and as far as attainments are concerned, we have a partial safeguard in that VRQ results obtained in P7 were available for all pupils and give some indication of the base level for each group. Unfortunately, similar measures for the other variables being studied were not available.

The following variables were derived from the tests administered to each successive year group or from school records.

(1) VRQ : Moray House assessed in P7.
(2) AQ : Attainment in arithmetic as assessed by NFER Number Test 1.
(3) EQ : Attainment in English as assessed by NFER English Test 2.
(4) School Anxiety } : Assessed by a test devised by the Educational Psychology Department—factor analytic studies indicating that it does measure these dimensions.
(5) School Dislike }
(6) Attitude to School : Thurstone-type scale devised by Fitt (1956).
(7) Extraversion } : Scores obtained on Junior Eysenck Personality Inventory (Eysenck, 1965).
(8) Neuroticism }

In addition, a simple sociometric test designed to ascertain the pattern of friendship relationships in both playground and classroom was also administered.

RESULTS

Table 1 gives the mean and standard deviation for each group on each of the tests used for the total sample and for boys and girls separately, the significance of difference between the means being estimated by the application of the *t*-test for independent samples (Ferguson, 1966).

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR EACH YEAR GROUP.

			VRQ (1)	AQ (2)	EQ (3)	School anxiety (4)	School dislike (5)	Attitude to school (6)	Extra-version (7)	Neuroticism (8)
Group D (Direct)		Boys N=131	97·60 (14·93)	100·58 (14·90)	102·27 (11·65)	7·33 (3·67)	2·51 (2·28)	4·54 (1·07)	15·71 (3·31)	11·98 (5·28)
		Girls N=123	100·72 (12·22)	98·69 (14·07)	105·26 (11·29)	8·21 (3·81)	1·91 (1·75)	4·19 (2·49)	15·77 (3·14)	13·89 (5·22)
		Total N=254	99·11 (13·77)	99·67 (14·54)	103·72 (11·58)	7·76 (3·77)	2·22 (2·06)	4·37 (1·90)	15·74 (3·23)	12·91 (5·34)
Group T1 (Transition)		Boys N=133	93·99 (14·50)	96·58 (13·04)	99·45 (12·25)	6·84 (3·21)	2·83 (2·28)	5·05 (4·13)	17·05 (4·04)	10·84 (4·76)
		Girls N=119	100·07 (12·66)	99·88 (13·15)	105·25 (11·62)	7·83 (3·83)	1·76 (1·70)	4·29 (1·00)	17·46 (3·64)	12·65 (5·32)
		Total N=252	96·86 (13·99)	98·14 (13·20)	102·19 (12·30)	7·31 (3·55)	2·33 (2·10)	4·69 (3·10)	17·24 (3·86)	11·69 (5·11)
Group T2 (Transition)		Boys N=127	96·17 (12·86)	97·73 (14·33)	100·80 (12·28)	6·98 (3·18)	2·92 (2·20)	4·59 (1·07)	17·23 (4·06)	12·24 (5·09)
		Girls N=107	99·64 (10·13)	100·80 (11·14)	105·59 (10·88)	6·93 (3·27)	1·16 (1·47)	3·62 (0·80)	17·02 (4·22)	11·27 (5·38)
		Total N=234	97·76 (11·82)	99·14 (13·06)	102·99 (11·90)	6·95 (3·22)	2·12 (2·09)	4·15 (1·07)	17·13 (4·14)	11·80 (5·25)
Significance of Difference of Means	Group D Group T1	Boys	P·<05	P< ·05	ns	ns	ns	ns	P< ·01	ns
		Girls	ns	ns	ns	ns	ns	ns	P< ·001	ns
		Total	ns	ns	ns	ns	ns	ns	P< ·001	P< ·01
	Group D Group T2	Boys	ns	ns	ns	ns	ns	ns	P< ·01	ns
		Girls	ns	ns	ns	P< ·01	P< ·001	ns	P< ·01	P< ·001
		Total	ns	ns	ns	P< ·05	ns	ns	P< ·001	P< ·05
	Group T1 Group T2	Boys	ns	ns	ns	ns	ns	ns	ns	P< ·05
		Girls	ns	ns	ns	ns	P< ·01	P< ·001	ns	P< ·05
		Total	ns	ns	ns	ns	ns	P< ·01	ns	ns

(*a*) *Total sample.*

Examination of Table 1 indicates that the pupils in Groups T1 and T2 were more extraverted ($P < \cdot 001$) and more stable ($P < \cdot 01$ and $P < \cdot 05$) than the pupils in Group D. In addition, the pupils in Group T2 exhibited significantly less anxiety about school ($P < \cdot 05$) than the pupils in Group D.

When Groups T1 and T2 are compared the only significant difference obtained indicates that the Group T2 pupils were more favourably disposed to school ($P < \cdot 01$) than those in Group T1.

It would thus appear that, for the total sample at least, where significant differences did occur they were in the desired direction.

(*b*) *Boys and girls separately.*

(i) *Boys.* The boys in Group T1 had significantly lower VRQs ($P < \cdot 05$) and AQs ($P < \cdot 05$) than those in Group D. In addition, the boys were significantly more extraverted ($P < \cdot 01$) in Groups T1 and T2 than those in Group D, none of the other differences reaching significance at the ·05 level. The boys in Group T2 were, however, significantly less stable ($P < \cdot 05$) than those in Group T1.

(ii) *Girls.* When the girls are considered somewhat larger differences become apparent. Thus, the girls in both Groups T1 and T2 were significantly more extraverted ($P < \cdot 001$) and $P < \cdot 01$) than those in Group D and the girls in Group T2 showed significantly less anxiety about school ($P < \cdot 01$), greater liking for it ($P < \cdot 001$) and more stability ($P < \cdot 001$) than those in Group D. In addition, the girls in Group T2 showed less dislike ($P < \cdot 01$), more favourable attitudes ($P < \cdot 001$) and more stability ($P < \cdot 05$) than those in Group T1.

(*c*) *Ability level.*

It was felt that as the transition department appeared to have a differential effect on boys and girls the data should also be examined in terms of ability in P7 as defined by the pupil's VRQ. The sample was, therefore, divided into three groups—the high ability group consisting of pupils with VRQ> 110; average ability group VRQ 90–110 and low ability group VRQ <90. The results for each of these samples were then analysed in exactly the same way as before.*

The high ability pupils in Groups T1 and T2 showed significantly less dislike of school ($P < \cdot 05$) than the pupils in Group D. The pupils in Group T1 were also significantly more extraverted ($P < \cdot 05$) than those in Group D.

The medium ability pupils in Groups T1 and T2 were significantly more extraverted ($P < \cdot 001$) than those in Group D. The pupils in Group T1 were more stable ($P < \cdot 05$) than those in Group D and the pupils in Group T2 showed less anxiety about school ($P < \cdot 05$) than the Group D pupils. In addition, the Group T2 pupils had more favourable attitudes to school ($P < \cdot 05$) than those in Group T1.

For the low ability pupils (VRQ < ·90) only two differences were statistically significant, the pupils in Group T1 being better at arithmetic ($P < \cdot 05$) than those in Group D and the pupils in Group T2 having less anxiety about school than those in Group D.

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* For reasons of space it is not possible to publish all the tables, but these may be obtained on request from the authors.

(*d*) *Effect of school size.*

As was mentioned in the introductory section, one of the reasons for the introduction of the transition department was the hope that it might reduce the impact of entry to the large secondary school on pupils coming from relatively small primary schools. In order to ascertain if this hope had been realised each year group of pupils was dichotomised by allocating pupils to the *small school group* if their original primary school had fewer than 10 teachers and to the *large school group* if their original primary school had 10 or more teachers.

Analysis of the data in the usual manner gave the following results :

(i) Pupils in Groups T1 and T2 coming from *small schools* had significantly less anxiety about school ($P < \cdot 05$ and $P < \cdot 01$), greater extraversion ($P < \cdot 001$) and greater stability ($P < \cdot 05$ and $P < \cdot 01$) than similar pupils in Group D. In addition, the pupils in Group T2 had a significantly greater liking for school ($P < \cdot 05$ and $P < \cdot 01$) than those in either Group D or Group T1.

(ii) The pupils in Groups T1 and T2 coming from *large schools* were more extraverted ($P < \cdot 001$ and $P < \cdot 05$) than similar pupils in Group D, none of the other differences reaching significance.

(*e*) *Friendship choices.*

One of the things that also seemed to be worthwhile investigating about the Transition Department was whether it made it easier for children to widen their friendships to include pupils who had come from other primary schools. The sociometric test forms completed by the pupils were divided into school groups according to the primary schools which the pupils concerned had attended. From the school records it was then possible to find out how often each pupil had named as friends children who had been at the same primary school and how often he had named children who had been at a different primary school. These choices were categorised as *home* and *other* respectively. Table 2 gives the results obtained for each year group and for boys and girls separately.

TABLE 2

FRIENDSHIP CHOICES.

		Playground		Classroom	
		Home	Others	Home	Others
Group D ..	Girls (N=126)	237	151	209	169
	Boys (N=134)	238	164	229	173
	All pupils	475	315	438	342
Group T1 .	Girls (N=114) ...	175	167	168	174
	Boys (N=126)	201	177	191	187
	All pupils	376	344	359	361
Group T2 ..	Girls (N=98)	149	145	114	180
	Boys (N=106) ...	168	150	139	179
	All pupils	317	295	253	359

The pupils in Groups T1 and T2 made more friendship choices outside the home area ($P < \cdot 01$) than the pupils in Group D. Similarly, the pupils in Group T2 made more friendship choices outside the home area ($P < \cdot 01$) than those in Group T1 for the classroom situation, but there was no difference so far as the playground situation was concerned.

There was also a consistent trend, reaching significance at some points, for pupils in each year group to make choices outside their own area more readily in the classroom situation than in the playground situation. There were no significant differences between boys and girls as to willingness to make friends from other primary schools.

DISCUSSION AND CONCLUSIONS

The decision by the Banffshire Education Committee to open a transition department in Macduff for an experimental period aroused strong feelings in the local populations, especially amongst the parents of the children who would be involved, and was only reached by a majority in the committee and after much debate. On the one hand, there were those who claimed that one result of the transition year would be that, by making children, especially children from very small primary schools, more favourably disposed towards the secondary school experience and less anxious, higher standards of achievement in school subjects would be reached. On the other hand another body of opinion held that, as a result of taking children away from their local schools and busing them a year earlier, and then effectively changing their school again a year later, children would become more hostile and anxious about their school experience and their levels of attainment would deteriorate. As a result, although the situation was one where some kind of reasonably objective evidence was badly needed, it was also one where Hawthorne effect and Rosenthal effect might be expected to flourish, especially during the first year of the experiment. Consequently, the evidence produced needs to be interpreted with caution, and, especially, the most useful comparisons are likely to be those between Group D and Group T2.

As Table 1 shows, although there are slight differences in VRQ scores between the groups, these are very small. It, therefore, seemed justifiable to make direct comparisons between the groups. With regard to English and Arithmetic the scores were very similar in all three groups—neither the hoped for rise nor the feared decline has taken place. In each group the three measures concerning anxiety about and attitude towards school produced results that were logically consistent with each other, and between the groups there is a consistent, though slight, trend towards results that suggest favourable effects of the transition experience. This trend is more apparent where girls, or all pupils from very small schools, are concerned ; when pupils of different levels of ability were compared it was apparent that, as might be expected, in every group, for both boys and girls, pupils of high ability expressed more favourable attitudes towards school than those of average ability, and they in turn liked school better than those of low ability. When Groups D and T2 are compared, there is some evidence that the difference in attitudes between the most and the least able pupils is actually greater in Group T2 ; the transition department, therefore, offers no panacea as far as the attractiveness of school for the less able is concerned. On the other hand, although high ability pupils were the least *anxious* about school in each group, the pupils of average and low ability in Group T2 were significantly less anxious than their counterparts in Group D and were, indeed, very similar to their high ability contemporaries in respect of school anxiety.

The most clear cut differences between the groups were, surprisingly, on the scores obtained on the JEPI. The children in Group D recorded scores indicating that they were considerably less extraverted and less stable than average children of their age: their counterparts in Groups T1 and T2 were significantly more extraverted though still somewhat below the average of the comparative scores in the manual, and were significantly more stable, this time with scores close to the mean score in the norms. This would have been an especially useful test to give to the same children on two occasions, before and after experience of transition department or Primary 7 class. However, since all the groups came from the same areas and had had very similar experiences apart from this year, and on the assumption that scores on the two dimensions of personality measured are to some extent influenced by recent experiences (see, for example, Hare *et al.*, 1972), it seems permissible to suppose that these changes were related to the different experiences of the groups in the year before entering secondary school.

It is similarly regrettable, with regard to the friendship scores, that it was not possible to make a comparison between groups of children who had had the opportunity to get to know each other over an equal period of time. As it was, the children in Groups T1 and T2 had known each other for a year in the transition department before ever going to Banff Academy, whereas the children in Group D had only had a few weeks in the secondary school to become acquainted with children from other primary schools. It is scarcely surprising then that transition department pupils appear to have spread their friendships outwith their own area to a far greater extent, and that this applies to the playground as well as to the classroom situation, though it is perhaps noteworthy that Group T2 children are much more likely to refer to friends from outwith their own area than they are to friends within it. However, Banff Academy has a policy of deliberately producing mixed-area as well as mixed ability groups in the first year, and from the point of view of the form teacher trying to produce a cohesive group, or of the pupil from a remote area entering the large comprehensive school for the first time, the evidence here is that the sociometric situation is entirely different.

When the time came for a decision to be made on the permanent future of the transition department, the results quoted in this study, true to the tradition of educational research, tended to please nobody, but it was clear that a small but sometimes significant improvement in the social/emotional area had been taking place, without loss of academic attainment. The fact that this trend is more apparent with one ability level or with one sex rather than another, is of more interest to the researcher than to the administrator, who has to make a decision that affects all the children and, in the event, the most influential piece of evidence was provided by a re-run of the basic data so that comparisons could be made between pupils from small schools (nine teachers or fewer) and others. When this was done, the effects that have been noted above turned out to be considerably more marked with pupils from these small schools, and since the welfare of pupils from these schools had been the primary consideration when the decision was made to begin the experiment, this was probably the clinching evidence that made the committee decide to keep the transition department in being, although with certain administrative changes.

This exercise in co-operation between representatives of a local education authority and educational psychologists in a college of education has been a pleasant and valuable experience. The college people have learned that, though it is pleasant to produce research designs at leisure and to seek for marginally statistically significant differences in sub-groups, it is salutory to have to enter an ongoing situation and to seek to produce a summary of objective evidence on the basis of which a real decision has to be made. The Education Committee may have learned that there is a reassurance in being able to justify a local educational decision on the basis of reasonably hard evidence, and it is to be hoped that they have learned that, in any situation like this, it is much more useful if research workers are brought in at the planning stage rather than after the experiment has started !

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SOCIAL BACKGROUND, SPEECH AND LEARNING TO READ

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Summary. Samples of the speech of infant school children in a story recall task were analysed, and a moderately reliable measure of the structural complexity was devised. With this measure and with a standardised vocabulary test the language skills of children entering school from different social backgrounds were investigated. The relationship between speech and educational progress was explored with particular reference to learning to read. The speech of the socially disadvantaged children was rather less well developed than that of the advantaged, but at each testing during the first two years of schooling this difference lay in the frequency of use of various complex forms, not in their presence or absence. Differences between children within social groups were considerable. Reading ability was related to vocabulary skill; but there was no correlation with speech structuring skill, which was generally adequate in both groups to support early reading

INTRODUCTION

It is implied in certain approaches to the question of provision of pre-school education that the language experience of children before attending school is an important factor in determining the pattern of educational attainment, and there is a belief that by school age some children are so linguistically deprived as to be at an educational disadvantage. The nature of this deprivation is not always clearly specified, nor are the actual language abilities of either the supposedly advantaged or disadvantaged. Perhaps equally importantly, neither are the requirements made of children by learning activities inside schools.

If we exclude children who are clearly handicapped by poor functioning of the sensory, motor and nervous systems, and also those whose native language is not English and who obviously have very little grasp of it, there remain in our schools those children who have all learned English as a native tongue, some being bilingual, and who have done so from different pools of experience. Whether these differences result in relatively poor mastery of the forms of the language by some children, or in different habits of use of the same forms, or both, is debatable.

This paper is concerned primarily with description of the mastery of form evident in the speech of young school children, although some account has to be taken of differences in use, if only because sampling must occur in some sort of social context. Consideration of the relationship between forms of speech and their use can be found in the work of Hawkins (1969), Francis (1974) and Tough (1974), to mention an example or two; but recent treatment of levels of structuring ability is difficult to find. To describe children's speech one tends to resort to the American norms established by Templin (1957) in an interview situation. In that study a correlation between measures of social background and indices of speech complexity was evident, suggesting that different learning situations had led to different levels of skill, but it was clear that both within and between social classes there were marked individual differences associated with general cognitive ability. What could not be brought out was whether lower measures of speech skill indicated a lack of some aspect of knowledge of the language or a relative retardation in an otherwise similar pattern of development. The present study reports an attempt to compare overall indices of sentence complexity in samples of the speech of children from different social backgrounds, and to test whether the forms elicited in a standard task were equally present in the samples from both groups, relatively advantaged and disadvantaged. Findings are, therefore, not necessarily comparable with those from samples of spontaneous speech, for it is doutbful whether anyone displays ability to construct complex sentences equally in different contexts of speech.

Whatever the nature of possible differences in language ability between children from different backgrounds, however, it would be rash to assume that they might be entirely due to differences in available models and equally rash to consider that they contribute in large measure to differences in educational attainment, notwithstanding the correlation between social background and achievement. Other variables such as general intelligence or motivation to communicate in school might underlie both. It remains to be shown that differences in language skill are educationally significant, that they make the difference between success and failure in tasks in school. When the sampling of speech was undertaken for the research on which this paper is based it was also possible to monitor the children's approach to literacy. A further aim of this report is to consider the relationship between spoken language skill and progress in learning to read.

METHOD

Subjects.

Children were selected from schools in two different areas of Leeds. The NL group attended a primary school in an attractive residential area in the northern part of the city, while the SL group came from an inner-city southern area which was being redeveloped. New blocks of flats and corporation-owned estates were emerging in a wasteland of factories, old housing and cleared sites. According to information supplied by the head teachers, fathers' occupations ranged from the Registrar-General's Social Class I to III for the NL group, and from IV to V for the SL group. In several cases in the latter, fathers were absent from home or unemployed.

The NL group comprised all the children admitted in one half-year to the school. A longitudinal study was carried out, testing taking place at six-monthly intervals from a mean age of 5 years 9 months to one of 7 years 3 months. In all, 30 girls and 20 boys were present on all four occasions. The SL group could not be obtained entirely from the selected school, since the annual intake was much smaller, but all children for whom English was their native tongue, and who were between 5 years 6 months and 7 years 6 months in age, were tested; then to make up samples of 12 boys and 12 girls at each age level matching the NL testing, additional children were randomly chosen from a neighbouring school. For some comparisons between groups a sub-set of 12 boys and 12 girls was taken from the NL group, care being taken not to introduce bias into the speech scores, and 12 male and 12 female adult students retold the stories without knowing the basis of comparison.

About half the children in both groups had attended a nursery school or play group, but the information was not adequate to allow assessment of possible effects on speech and reading.

Tasks.

Pilot study work with other children indicated that different responses could be expected to various methods of sampling speech. Conversation between children yielded data that included a fairly high proportion of incomprehensible remarks and fragmentary utterances and themes. Moreover, some children spoke very rarely. Descriptions of pictures were fairly short and comments were not a particularly coherent account. Telling a story, on the other hand, or giving an account of some event, often yielded quite lengthy and coherent themes. But again, some children said very little and others were uninspired or shy. The task which was found to yield most organised speech from most children was that of retelling a story after listening to it, without any person present other than the story-teller and the child. Even shy children were more forthcoming, and no one was entirely without anything to say. The knowledge that they could listen to a recorded replay of their own story proved to be something of an incentive. The use of a standard task of this kind also allowed useful comparisons to be made between children's stories, adult versions and the model stories. Four such stories were devised to be parallel as to length and sentence patterning, and each child in the NL group retold a different story at each testing. For all groups at each age level the children were randomly allocated to the four stories. The actual stories used had been found in pilot study work to be most successful of those tried. While sentence complexity was varied the vocabulary was not demanding. A separate test of vocabulary was made at 7 years 3 months with the Stanford-Binet scale.

To explore the development of literacy the children were tested with the Schonell Graded Word Reading Test, and their progress through the school reading scheme was monitored.

Analysis of speech.

The children's stories were transcribed from tape-recordings, and the transcriptions were analysed. The amount of speech was measured by the number of words, excluding immediate repetitions and corrections. Sentence boundaries were determined after a consideration of both structure and meaning, and when a clause could have belonged to a sentence on either side the intonation and pauses were also examined.

There are so many facets to the notion of sentence complexity that justice cannot be done to all at once. The patterns of clause and phrase structure are of prime importance, however, and in this study emphasis was laid on clause patterning. In order to identify clauses, insights from recent structural linguistics were used. While for a full treatment of the defining scheme the reader is referred to Francis (1971), it is sufficient to say here that both simple sentences and clauses were treated as sentence units, the independent and dependent clauses of complex sentences being termed matrix and embedded sentence units. Sentence units so loosely conjoined as to be separable and meaningful if the conjunction were ignored were treated as separate units. The treatment of phrases was not quite like that in the Templin study; some were considered to be phrases within a sentence unit, while others were seen as reduced forms of embedded units. It seemed possible that a case might be made for the treatment of some adjectives as reduced relative clauses, and the findings reported in this paper are based on such treatment, but while exploration of the alternative traditional treatment of them as belonging to noun phrases revealed minor differences in the obtained complexity indices, it did not affect findings in comparisons between age levels and groups. The index of complexity adopted was the simple ratio between the number of sentence units and the number of sentences in a sample of speech. The analysis also allowed each sample to be described in terms of the numbers of sentences combining different numbers of sentence units.

Further analysis of patterning was undertaken by describing the forms of the embedded units and their ordering within sentences, and some attempt was made to define the nature and incidence of grammatical errors.

RESULTS

Vocabulary.

At 7 years 3 months the Stanford-Binet vocabulary scores for the 50 NL children gave a mean of 8·88, a standard deviation of 2·06, and a range of 3–13. Those for the 24 SL children gave a mean of 8·12, a standard deviation of 1·64, and a range of 5–12. Although both means were above the early standardisation level of the test, the standard deviation of the NL scores matched it well. That for the SL group showed the reduction expected with a smaller sample, but the standard errors of the means for each group were very close and the difference of 0·76 between means was statistically significant at the ·05 level. The difference between means amounted to something like an age gap of eight or nine months.

Speech structure.

It was noteworthy that in retelling the stories both children and adults adhered to the content, but, as in all such recall tasks, they gave shortened versions. Since the NL children were observed repeatedly, it was possible to assess the reliability of the sampling of speech. Kendal rank-order correlations were obtained between scores for the combined first two and last two testings. The coefficient for amount as measured by the number of words per story was 0·48 ($P < \cdot 01$) and that for complexity as measured by the ratio of sentence units to sentences was 0·20 ($P < \cdot 05$). If samples of fewer than five sentences were excluded the reliability improved. A Wilcoxon matched-pairs, signed-ranks test showed consistent, statistically significant increases in scores at each testing, and this was taken to indicate a certain validity.

TABLE 1

STRUCTURE AND AMOUNT OF SPEECH IN THE STORY REPRODUCTIONS.

Subjects	Sample measure		
	Av. No. Words	Complexity ratio	Av. sentence length
NL group (N=24)	(N=50)	(N=50)	N=50)
5 years 9 months	69 (65)	1·63 (1·63)	8·5 (8·6)
6 years 3 months	84 (78)	1·72 (1·65)	8·7 (8·8)
6 years 9 months	110 (103)	1·74 (1·73)	9·1 (9·2)
7 years 3 months	123 (119)	1·97 (1·86)	9·7 (9·5)
SL group (N=24)			
5 years 9 months	66	1·48	7·4
6 years 3 months	84	1·44	7·5
6 years 9 months	101	1·67	8·6
7 years 3 months	116	1·76	8·1
Adults (N=24)	230	2·37	12·3
Models (N=4)	326	2·34	11·5

The mean scores at different testings for the children and adults are shown in Table 1. From the number of words per sample it can be seen that the children produced longer stories as they grew older, but that they did not reach the adult level. There were no differences between the two groups of children, the socially less advantaged not being less fluent in this task. It does emerge, however, that the mean length of sentence was lower for the SL group, suggesting a more limited use of clauses within sentences. This was borne out by the figures for the ratio of sentence units to sentences in the combined samples for each group. These complexity indices indicated an age-equivalent difference of about six months, the SL group having the lower scores. Although neither group of children attained scores equal to those for the model stories the adults achieved a higher index of complexity. This indicated that the structuring of the models did not act as a constraint.

TABLE 2

PERCENTAGE FREQUENCIES OF SENTENCES OF DIFFERENT LEVELS OF COMPLEXITY.

Subjects	Number of sentence units per sentence					
	1	2	3	4	4 +	Total
NL group (N=24)						
5 years 9 months	34	39	15	7	5	100
6 years 3 months	29	39	20	7	5	100
6 years 9 months	30	36	20	7	7	100
7 years 3 months	22	31	25	12	10	100
SL group (N=24)						
5 years 9 months	45	28	20	4	3	100
6 years 3 months	45	36	16	3	0	100
6 years 9 months	34	35	16	8	7	100
7 years 3 months	28	39	19	8	6	100
Adults (N=24)	14	24	26	17	19	100
Model (N=4)	11	33	31	15	10	100

In order to make a comparison of the kinds of sentence structure used by the two groups the stories of the SL children were compared with those of the sub-set of 24 NL children. Table 2 shows the percentage frequencies of sentences of different degrees of complexity. When chi-square tests were applied to the actual frequency distributions it was found that all four differed significantly from each other at the ·01 level. For sentences of four or more units the adults produced proportionately more than the model while the children gave fewer. The latter, on the other hand, produced proportionately more sentences of one or two units. The differences between the children were such that the NL group gave more three-unit and longer sentences and fewer simple and two-unit forms than would be expected if the children were regarded as a homogeneous group, while the reverse was true of the SL children. It should also be reported, however, that some children occasionally produced some very complex sentences and in a few cases stories were comparable with some of the adults, but the children who achieved these also had scores on the vocabulary test at the 10- or 11-year level. Since this was the case an attempt was made to compare indices of structural complexity holding vocabulary constant. It was possible to match 15 pairs of children from the two groups, at 7 years 3 months for age, sex and vocabulary score, and then no significant difference was found between the complexity scores of these sub-groups of the NL and SL children, although the SL scores were marginally lower.

For both groups of children there were was a significant Kendall rank-order correlation of more than 0·5 between scores for amount and complexity of speech. This was not true for the adults, for whom the correlation was zero. Indeed, they were able to outdo the model in complexity with an accompanying reduction in amount. At some level of ability to give a coherent account sentence structuring became independent of the number of words used.

Analysis of the actual grammatical structure of the sentence units used in the retelling showed no differences between the groups of children or between them and the adults. All three groups produced units of conjunction of different kinds, substitution of units for phrases in matrix units, qualifying units and units expressing temporal, locative, purposive, conditional and other relations with the matrix unit. They also produced these in similar proportions and showed a strong tendency to use structures present in the model. In constructing sentences, in the actual selections and combinations of units in complex sentences, however, all three groups differed from each other and from the model. It was possible to retell essentially the same story using a variety of sentence patterns. Moreover, although complexity seemed to accompany thematic organising ability, simplicity of expression was as effective as complexity for some purposes.

Inspection of the nature and distribution of grammatical errors revealed that both groups of children found the more complex forms difficult. This was shown in errors of word order, of inappropriate, redundant and omitted conjunctions and of pronoun agreement between clauses. The frequency of occurrence of such errors is shown in Table 3. There also are shown errors which suggest differences between the groups. Past participle errors are quite common in children of this age, but the SL children made more of them, a finding that suggests a relative immaturity or lack of experience. An error that might more properly be attributed to differences of style was the systematic inversion of *were* and *was* by the SL children. This was a feature of parental speech. Perhaps the most interesting difference was the reduction in error with age for the NL group and the increase for the SL group. As the latter attempted more complex sentences they made more errors, another consequence perhaps of relative lack of experience.

Additional stylistic differences were noted in a breathy, almost absent *the*, a tendency to use more direct than indirect speech in retelling events and the omission of the auxiliary *had* in the pluperfect tense in the speech of the SL children compared with that of the NL group. As far as could be judged these seemed to reflect parental speech.

Summarising the analysis of structure in the spoken stories, it is possible to say that there were considerable differences between children, and that those between children within groups were greater than those between groups. On average there was considerable headroom for development to an adult level. Differences between the two groups of children amounted to a retardation of about six months in vocabulary and sentence complexity scores for the socially less advantaged group, a difference that was maintained over the two years of testing. But when vocabulary scores were matched, differences in structuring skill in a task involving easy vocabulary tended to vanish. The differences in scores were not indicative of qualitative differences, for both groups of children used the same kinds of structure, but the SL children were slower to come to them and made more errors in their use.

TABLE 3

DISTRIBUTION OF GRAMMATICAL ERRORS IN CHILDREN'S SPEECH.

Subjects	Errors				
	verb tense or mood	were/was inversion	pronoun agreement	clause relation and word order	total
NL group (N=24)					
5 years 9 months	16	5	9	10	40
6 years 3 months	10	3	6	8	27
6 years 9 months	8	4	12	7	31
7 years 3 months	7	1	6	8	22
SL group (N=24)					
5 years 9 months	17	17	7	8	49
6 years 3 months	17	21	5	5	48
6 years 9 months	17	24	17	9	67
7 years 3 months	23	31	11	9	74

Speech and reading.

Taking the two measures of reading progress together it was found that Kendall rank-order correlations between scores on the Schonell Graded Word Reading Test and teachers' rankings based on progress through the school reading schemes were about 0·9. Since the Schonell measures were common to all the children, they were used for comparisons between them and for exploration of relationships between reading and speech skills. The average reading ages for the two groups of children are shown in Table 4 (*a*). There is evidence of a clear tendency for the NL children to make more progress in the second year of schooling, this advance possibly being related to unmeasured difference in the first year when the testing was more useful in revealing differences between individuals than in identifying those between groups. In the first year reading skill was in its very early stages, but by 7 years 3 months the NL group was more ready to meet the literacy demands of formal education.

TABLE 4

MEASURES OF SPEECH AND READING.

(*a*) Reading scores

Age	Group of children		
	SL group (N=24)	NL group (N=24)	NL group (N=50)
5 years 9 months	5·2 years	5·3 years	5·3 years
6 years 3 months	5·5 years	5·8 years	5·8 years
6 years 9 months	6·4 years	6·3 years.	6·3 years
7 years 3 months	6·8 years	7·2 years	7·1 years

(*b*) Rank-order correlations between speech and reading measures.

	SL group (N=24)	NL group (N=24)	NL group (N=50)
Vocabulary	0·57*	0·43*	0·32*
Speech amount	0·49*	0·14	0·26*
Speech complexity	0·16	0·09	0·20

*—significant at ·01 level

Kendall rank-order correlations between reading scores and measures of speech skill are given in Table 4 (b). It can be seen that reading achievement bore no relation to speech complexity for either group of children, and only a marginally significant correlation with amount for the NL group, although it was definitely correlated with amount for the SL group. Perhaps for the SL children readiness to talk in certain contexts was an important aspect of learning to read. For both groups of children there was a significant association between vocabulary and reading skills, although it was not always the case that children were familiar with the words they could read.

DISCUSSION

Halsey (1972) reported the results of vocabulary tests on infant school children in areas so disadvantaged as to have been designated Educational Priority Areas, and showed distinct differences between the distributions of scores of immigrant children, who had had little opportunity of learning English systematically, and of native English-speaking children. For the latter, means from 2 to 8 points below the norm were obtained in roughly normal distributions of scores, implying some limitation of experience ; while, for the former, the distributions were very irregular and the means another 15 to 20 points lower, suggesting real deprivation. It would not, therefore, be strictly correct to speak of the socially disadvantaged as linguistically deprived. In the present study both the vocabulary test and the measures of speech complexity yielded roughly normal distributions of scores for both groups of children, and the difference between means suggested some limitation in learning in the lower compared with the higher social class group. The disadvantaged had not been deprived of opportunities to learn quite complex forms of speech, but their errors and relative retardation suggested less practice in their use. In the face of some of the more extravagant claims about differences between children from different social backgrounds, and of statements such as are to be found in Plowden (1967) and in Halsey (1972), referring to the poor command of language and the considerable handicap on entering school of socially disadvantaged children and of those brought up in homes where the forms of speech are restricted, the differences found in this study might be thought rather small. In effect it is claimed that it is possible to find tasks to promote quite highly organised speech in which relatively slight differences are found between children from widely different social backgrounds attending schools whose histories suggest that only a few of the less advantaged might enter higher education whereas about one in five of the more advantaged could do so. The results do not, of course, suggest that in all circumstances the children would make roughly equivalent use of language, only that complex forms were part of the competence of both groups. Rather than referring to differences along a dimension of deprivation it would be better to say that the two groups of children had learned to form speech in very similar ways from different pools of information. The socially disadvantaged had learned to speak a form of English that was not quite standard, with a vocabulary that did not include the same range of concepts as that of the advantaged; and it was probable that they used forms of speech in different ways in different social contexts.

It might be thought however that a story reproduction task would allow children to imitate forms not amongst those whose construction they had mastered, and that this might favour the disadvantaged. Yet, although adherence to the semantic content of the stories led to a tendency to reproduce clauses like those in the models, echoic recall was not much in evidence. Even within clauses grammatical features of local speech and errors in form suggested a process of reconstruction rather than simple imitation ; while at the level of complexity under investigation—the combination of clauses in sentences—there was so much variety in the forms produced and so little correspondence with the model stories that imitation as a variable seemed to be ruled out. Moreover, since comparison with the models and with adult performance showed headroom for both groups of children it cannot be said that the task necessarily favoured the lower social class group.

In view of the fact that testing began in the first year of schooling and that group differences were maintained throughout, it can hardly be said that the schools had any marked effect on them, although efforts by the local education authority to treat the schools in the poorer area with special consideration may have prevented further relative retardation. The fact was that at five years most of the disadvantaged children were well enough equipped linguistically to be in a position to benefit from schooling, and the major effort in teaching was not to make up a language deficit, but to bridge the differences in experience of speech to establish mutually meaningful conversation as a basis for readiness to learn in a more general sense. This is necessarily the principal educational task facing schools whatever the age of the pupils. The tendency for educational disadvantage to become even more apparent during the school years cannot be countered simply by attending to children's experience in the pre-school years, nor by adding more of the same kind of resource as at present exists in schools, valuable though these may be. The full significance for educational aims of continuing different pools of background experience between social groups has probably not yet been adequately explored. In the case of children entering school this study would seem to suggest that we need to be more clear about their abilities than we are at present, and fuller investigation on a wider scale would be helpful. Teacher expectations can influence the choice of content and method in teaching, and may do so to the advantage or disadvantage of the children (Beez, 1972). It is worth considering that emphasis on already existing skills can only further retard pupils who might otherwise be strengthening their skill and undertaking further general learning at the same time.

In view of the findings of differences in level of speech skill between social class groups, and of considerable differences within groups, it is important to discuss the possible sources of variation. The high correlation between the Stanford-Binet vocabulary scale and the complete intelligence scale would lead one to suppose that the difference between social groups corresponded to a mental age difference of about six months. This delay in development in the disadvantaged was likely to be due to a combination of relative lack of relevant learning and a generally lower level of functioning attributable to the physical and nutritional handicaps associated with poverty. The differences in speech scores between individuals within groups were, however, greater than those between groups, and probably reflected factors such as variation in general ability and differences in family experience. Characteristics such as shyness probably contributed additional variance, but some children undoubtedly showed quite limited ability in speech which was neither generally nor solely characteristic of the disadvantaged.

It is sometimes claimed, as in a report of the Department of Education and Science in 1970, that learning to read is closely bound up with the development of spoken language, and that differences between children in attaining this skill are crucially related to differences in early language experience. School reading books have been criticised in that they have tended to cover the vocabulary of middle class rather than lower class social groups, and vocabulary score differences would certainly suggest that attention should be paid to catering for a variety of interests and experience, but they do not suggest that the vocabulary of disadvantaged children is in general inadequate as a basis for learning to read. Within both social groups in this study, however, there were some children with very low vocabulary scores, and an equivalent and significant correlation was found between reading and vocabulary scores for both groups.

That disadvantaged children who talked more readily in the testing context also tended to learn to read more easily, while this was not the case for the advantaged, was noted with interest. Perhaps for the disadvantaged willingness and ability to talk with an adult in school was an important factor in learning to read. Since there was no significant correlation between reading ability and complexity of speech for either group of children it seemed that a relatively simple level of speech was adequate to support early steps in reading. It will be recalled, however, that the reliability of the complexity measures was low for use in tests of correlation. More reliable scores based on more samples from each child, together with tests with larger numbers of subjects, might yield a higher level of correlation, although it would still be likely to be small compared with the associations of reading skill with vocabulary and speech amount.

During the second year of schooling, as reading skill developed, the advantaged children began to pull ahead. Questioning the children in both groups revealed that this was likely to be due in part to background differences in the amount of reading the children attempted at home and to the limited kind of reading available to the older disadvantaged group. But it might also be that more advanced reading correlated more highly with complexity of speech. Loban (1963) and Strickland (1962) reported a lack of such correlation at early stages of learning, but they found an increasingly significant one as texts became more demanding. More of the relatively advantaged children were reading stories fluently. If speech skill was becoming more relevant at that stage then additional experience with thematic speech might well assist the poorer readers, but there was no evidence in this study that the speech of the disadvantaged was structurally too poor to support such development of fluency. Indeed, in this, as in other aspects of learning, some children from poor circumstances were, at this stage of their school lives, making very good progress.

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RESEARCH NOTES

A COMPARISON OF TWO METHODS OF IMPROVING PROSE COMPREHENSION IN EDUCATIONALLY SUBNORMAL CHILDREN

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SUMMARY. Two attempts to facilitate the aural reception of prose material in educationally subnormal children were compared. The methods used were (1) to show illustrations of items occurring in the details as they were presented, with the aim of aiding imaginal, in addition to verbal, recoding, and (2) to slow the rate of presentation of the material to allow more time for the subjects to analyse and store the information. Both methods produced similar significant improvements in recall performance that were large enough to be of practical usefulness. Ways of studying the recoding performance of educationally subnormal children to provide information to enable further improvement in reception were examined.

INTRODUCTION

For the reception of aurally presented prose material the learner requires both the necessary recoding strategies to translate the sounds heard into forms that can be stored in memory, and sufficient time during the presentation to employ them. Spitz (1966) has contended that the poor performance of the educationally subnormal child is due to inefficient recoding. If this is so it should be possible to facilitate prose comprehension by providing recoding aids and employing slower presentation.

For recoding to be improved the types of recoding used in prose reception must be considered. Paivio (1972) has proposed a dual-coding theory of memory in which new material is stored in both verbal and imaginal forms. The introspective consideration of a sentence like, " The young girl walked with her friends along the banks of the river " suggests that the translation into imagery is probably an important form of recoding of predominantly concrete material. It has been found that dual recoding is superior to single in paired associate learning ; the instruction that subjects should think of a picture to link word pairs produced better performance than no such instruction (Levin *et al.*, 1973) and that giving a sentence to link a pair of pictures facilitated learning of the pair in mentally retarded subjects (Gordon and Baumeister, 1971). Applying these findings to prose material it is likely that reception by slow learning children would be helped by the presentation of visual representations of the objects and actions described in the detail, because they would prompt the subject to recode imaginally as well as verbally. In addition, they would provide visual images for the verbal labels where the learner has none, and also in the other cases save the subject the time necessary to search memory and find the relevant image.

A further factor limiting comprehension is the time available for recoding words in a detail before further words are received and demand attention. Glanzer *et al.* (1969) showed that, after the presentation of a word list, the reception of further words during a retention interval caused the displacement from memory of the later items in the list because they were incompletely analysed when the additional words were received. This finding probably explains why the reception of time-compressed speech shows a fairly linear decrease in comprehension as word rate is increased from approximately normal speech rate (150 wpm) to 400 wpm (Foulke, 1971). The effect of slowing the presentation rate to 78 wpm was studied by Woodcock and Clark (1968) who found that this improved recall compared to normal rate for subjects of below average IQ (mean 89). Thus, slower than normal presentation rate should help educationally subnormal children by compensating for their slowness in recoding.

The present study compared an attempt to improve listening comprehension in educationally subnormal subjects by providing images of the concepts in prose detail to facilitate recoding, with compensation for slowness of recoding by using very slow presentation.

METHOD

Subjects.

The subjects were 100 children (74 boys and 26 girls), aged between 9 and 16 years (mean 13·93 years, sd 1·58) who had been officially designated as educationally subnormal (mean IQ 67·68, sd 9·02) and attended a residential special school. Most subjects were also maladjusted.

Materials.

The learning material was the first 185 words of the prose passage "A story of Rhodopis : A Queen of Egypt" written for children by Polkinghorne and Polkinghorne (1961). This was tape-recorded by a teacher known to all the subjects, first at normal speech rate (155 wpm) and then at a slower rate (91 wpm). A third recording was made from the slower one by inserting additional pauses at selected points and this gave an overall rate of 73 wpm. The selection of positions for the insertion of pauses will be detailed below.

Visual material to be used in conjunction with the recordings to facilitate imagery production consisted of seven pictures, each 40 cm. high and 50 cm. long. Each picture depicted an object or objects associated with the ancient Egyptian subject matter of the prose material (e.g., river Nile, Pharaoh, sun god) rather than a scene from the story. In addition, a globe showing Egypt and an earthenware jug were also displayed. A total of 14 items connected with the passage were illustrated. The pictures were insufficient in themselves to convey the sense of the prose. The aim was to aid the subject's production of visual images and not to present the detail in visual form.

A recall test of 43 questions was constructed to test comprehension of the prose passage following the method of Bormuth (1970) in which questions are formed by taking the wording of a detail in the prose and replacing the part required for recall by a *wh*-pronoun and where necessary a verb.

Design and Procedure.

The subjects were randomly allocated to five experimental groups. Four of the groups were used in the main experimental design in which Group A listened to the normal speech recording (155 wpm), Group B received the normal speech recording plus the visual material, Group C received the lowest rate recording (73 wpm) and Group D were given the lowest rate recording plus the visual material. The fifth group E, were presented with the initial slow rate recording (91 wpm) and on the basis of their performance the lowest rate recording was made by copying it and inserting pauses in the details that were found most difficult by Group E, to reduce the presentation rates of those details.

Subjects were tested individually by the teacher who recorded the material. Each child sat one metre from the loudspeaker. Groups B and D also had visual material displayed in front of them at a distance of two metres and, as the recording was played, the teacher pointed to the appropriate illustration just before the item depicted was mentioned in the story. Immediately after the presentation the subject was seated facing the opposite wall of the room and the recall test was orally presented and the teacher recorded the subject's responses.

RESULTS

The recall test performance for each group is given in Table 1.

A two-way analysis of variance was performed on the data of the four main experimental groups A, B, C and D, and is summarised in Table 2.

TABLE 1

THE EFFECT OF PRESENTATION RATE AND VISUAL MATERIAL ON RECALL PERFORMANCE

Visual Material	Mean Number of Questions correctly answered at Presentation Rate (WPM)		
	155	91	73
Absent	Group A 12·1	Group E 17·9	Group C 19·9
Present	Group B 20·1	—	Group D 28·1

TABLE 2

ANALYSIS OF VARIANCE OF SCORES ON RECALL TEST.

Source	df	MS	F	P
Visual Material (A)........	1	1125·00	32·74	<·001
Presentation Rate (B)	1	1445·00	42·05	<·001
A×B	1	4·05	0·12	
Error	76	34·36		

The hypothesis that the presentation of illustrations of items in the prose material at the same time as the relevant detail would facilitate the reception was supported. The effect of the visual material was highly reliable (F=32·74, df 1/76, P<·001). Similarly, the effect of slowing the rate of presentation also produced a significant improvement in recall performance (F=42·05, df=1/76, P<·001).

DISCUSSION

Both the inclusion of visual material and decreasing presentation rate produced improvements in recall performance that were large enough to be of practical value, as inspection of Table 1 shows. Further, the combined effect of the two treatments on Group D showed that they supplemented one another in their facilitating influence. Since the magnitudes of the improvements in performance were almost identical for both methods and as the facilitation is observed to depend on the extent to which either effect is applied, neither method can be said to be superior. Consideration of the individual questions revealed that decreasing presentation rate produced a more even improvement over all questions than did the inclusion of the visual material but, of course, it was applied over all the material while the illustrations were related only to specific details. Further inspection of the performance on each question revealed that those that were found either very easy or very difficult, by the normal speech Group A, showed little improvement as presentation rate was decreased, whereas performance on those of intermediate difficulty was substantially increased. By contrast, those details that had visual material presented with them showed large improvement for both the intermediate and very difficult questions. It appears that the methods have different applications ; slowing the presentation rate is effective in facilitating the reception of details that are not too difficult to recode but for which it is assumed the educationally subnormal child requires more time, while giving visual material both facilitates recoding and provides the verbal label with the relevant image where none exists in the subject's memory.

The precise reasons for the facilitating effect of dual recoding are as yet not clear. Rohwer (1970) has argued that the presentation of pictures with verbal material enhances learning only when the two are stored together in memory, and that improvement in performance when pictures are present is not due to imaginal recoding in the place of verbal. Since, as has been noted for paired-associate learning, verbal stimuli can mediate for visual as well as visual for verbal, it appears that one form of recoding is not more basic than the other. It may well be, as Craik and Lockhart (1972) have suggested, that the degree of learning is proportional to the number of recodings completed. In the present study the presentation of the visual material with the verbal detail probably facilitated dual recoding.

Further improvement of prose reception requires the determination of whether the slowness in recoding by educationally subnormal, compared to that of normal, children is due to the utilisation of inefficient recoding strategies or to a general slowness of reaction, or to both. There is evidence that coding efficiency as expressed by chunk size is related to verbal ability (Craik and Masani, 1969), and that, relative to normal children, educationally subnormal subjects find it difficult to impose their own organisation on aurally received word strings having uniform pauses between words (Sitko and Semmel, 1972). However, the exact forms of recoding used by educationally subnormal children await investigation. Two related questions arise : (*a*) do educationally subnormal children recode speech in units of the same size, and (*b*) do they use the same memory codes as normal children ? The determination of the size of the recoded units (Riding, 1975), and of the speed of recoding to a given level of memory code (Riding, 1974), of educationally subnormal children would permit improved methods of facilitating prose reception to be devised.

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CONVERGERS AND DIVERGERS : DIFFERENT FORMS OF NEUROTICISM ?

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In *Frames of Mind*, Hudson (1968) makes the interesting suggestion that neuroticism in convergers and divergers tends to take different forms. In a study of the personalities of convergent and divergent schoolboys, he found that they did not differ in extraversion, but the divergers were significantly more neurotic. In an item analysis, he found that this difference depended mainly on eight items of the Maudsley Personality Inventory which referred to feelings of depression or guilt. Thirteen items contributed little or nothing to the discrimination, but three items about touchiness and restlessness tended to positively identify the convergers. Hudson (1968) concluded that " both divergers and convergers are capable of owning up to neurotic symptoms . . . each in their own fashion, the one depressive and the other over-controlled."

We have been able to investigate this possibility in our study of the cognitive and affective characteristics of university undergraduates (Child and Smithers, 1971). A sample of 150 social science students (90 men, 60 women) and 156 science students (123 men, 33 women) entering the University of Bradford in 1968 completed a number of cognitive tests and personality measures (see Child and Smithers, 1971, for details) including the Eysenck Personality Inventory (1964), the AH5 test of intelligence (Heim, 1956) and two divergent thinking tests ' Uses of Things ' (Getzels and Jackson, 1962) and ' Consequences ' (Torrance, 1962).

Convergers and divergers were identified from their relative performances on the AH5 and divergent thinking tests in the manner described by Hudson(1966) The students' fluency scores on the ' Uses ' and ' Consequences ' tests were ranked and the ranks combined (r= +0·51). The combined ranks and the total AH5 scores were each graded on five-point scales in the proportions 1 : 2 : 4 : 2 : 1 and cross-tabulated to give differential scores. For example, a student among the top 10 per cent on the divergent thinking tests, but among the bottom 10 per cent on the AH5 would obtain a differential score of +4. Students with differential scores of ±2 or greater were classed as convergers or divergers, according to the bias of their performance.

TABLE 1

Levels of Extraversion and Neuroticism.

	Divergers (N=51)		Convergers (N=53)		Allrounders (N=202)		t-tests
	M	SD	M	SD	M	SD	
Extraversion ..	12·51	4·30	11·66	4·07	12·02	4·12	D/C 1·03 D/A 0·73 C/A −0·57
Neuroticism....	11·04	4·83	12·09	4·37	10·98	4·47	D/C −1·16 D/A 0·08 C/A 1·64

TABLE 2

RESPONSES OF CONVERGERS AND DIVERGERS.

Items of EPI	Per cent ' Yes '	
	Convergers (N=53)	Divergers (N=51)
1. Long for excitement	78·4	64·7
2. Need friends to cheer you	58·8	52·9
3. Usually carefree	46·0	56·9
4. Hard to take ' no '	37·3	52·9
5. Stop and think first	82·0	78·4
6. Always keep promises	58·8	47·1
7. Moody	80·4	70·6
8. Don't stop to think	47·1	54·9
9. " Just miserable "	68·6	62·8
10. Anything for a dare	3·9	15·7
11. Shy-stranger	72·6	72·6
12. Lose temper	78·4	84·3
13. Spur of moment	64·7	64·7
14. Worry	82·4	76·5
15. Prefer reading to people	15·7	19·6
16. Easily hurt	47·0	51·0
17. Like going out a lot	74·5	74·0
18. Thoughts and ideas secret	84.3	84·3
19. Sometimes energetic, sometimes sluggish	82·4	74·5
20. Few but special friends	66·7	72·6
21. Daydream	64·7	54·9
22. Shout back	56·9	51·0
23. Guilt	60·8	41·2
24. All habits good ones	10·0	9·8
25. Let go at party	66·7	74·5
26. Highly-strung	25·5	23·5
27. Very lively	46·0	51·0
28. Feel could have done better	86·3	84·3
29. Quiet with others	58·8	48·0
30. Gossip	56·9	64·7
31. Insomnia	72·0	62·8
32. Look in books rather than ask people	35·3	39·2
33. Palpitations	52·9	58·0
34. Prefer work that needs close attention	76·5	62·8
35. Shaking attacks	23·5	17·7
36. Always honest	29·4	21·6
37. Hate practical jokes	45·1	45·1
38 Irritable	21·6	25·4
39. Prefer to act quickly	52·9	64·7
40 Worry about what might happen	49·0	43·1
41. Slow and unhurried	27·5	35·3
42. Late for work	78·4	82·4
43. Nightmares	5·9	5·9
44. Like talking to people	11·8	7·8
45. Aches and pains	19·6	23·5
46. Like people	47·0	52·9
47. Nervous person*	45·1	21·6
48. Dislike some people	68·6	84·3
49. Self-confident	51·0	64·7
50. Easily hurt	56·9	47·0
51. Hard to enjoy lively party	25·5	15·7
52. Inferiority	49·0	41·2
53. Get life into dull party	18·0	35·3
54. Talk without knowledge	66·7	74·5
55. Worry about health	23·5	25·5
56. Like playing pranks	33·3	32·0
57. Sleeplessness	25·5	17·7

* $P < \cdot 05$.

Of the 306 students, 53 came out as convergers and 51 divergers. Thirty-five of the convergers were scientists and 38 of the divergers were reading non-science subjects. Female students were proportionately represented among the groups.

The data of Table 1 show that, in accord with Hudson's (1968) observations, there does not appear to be a difference in the levels of extraversion among divergers and convergers or, for that matter, all-rounders. But, for our sample, neither was there a difference in levels of neuroticism.

When the 24 items of the neuroticism scale were examined individually (Table 2), only one, "Would you call yourself a nervous person ?", which more convergers said "yes" to, gave a value of χ^2 (with Yates' correction) beyond the 5 per cent level of significance, and only one other, "Are you often troubled about feelings of guilt ?", gave a value in excess of three. This was one of the items listed by Hudson (1968) as tending to identify divergers but, in the present study, it was endorsed by more convergers. A single significant difference across the 24 items is what could have been expected by chance alone.

In this study we have been able to support Hudson's (1966) contention that convergence/divergence is linked to arts/science specialism, and elsewhere we have shown that convergers and divergers differ in subject interest (Child and Smithers, 1973), occupational interests and attainment (Smithers and Child, 1974), and in degree of syllabus-boundness (Smithers *et al.*, 1975). But we can find no support for different forms of neuroticism among convergers and divergers.

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A COMPARISON OF THE DEGREE RESULTS OF UNIVERSITY STUDENTS FROM CO-EDUCATIONAL AND SINGLE-SEX SCHOOLS

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SUMMARY. The university degree results of students from co-educational and single-sex schools were compared and found to be closely similar except that more first year drop-outs may occur among the single-sex educated students. The sample consisted of 221 matched pairs and was drawn from those who took the WJEC examination in a three-year entry to Welsh university colleges, well before the students sat their finals. Variables matched or separated were Arts/Science, sex, population of school area, social class, university institution and various aspects of A-level attainment.

INTRODUCTION

Dale and Miller (1972) compared the first year university progress of students from co-educated and single-sex schools using a matched pair procedure on a sample drawn from the University of Wales. In Arts subjects there appeared to be virtual equality, but in Science the co-educated students seemed to do slightly better. If this difference is genuine and if the adverse effect on single-sex educated students continues throughout their university career, they should obtain noticeably poorer degrees than co-educated students. In this study the previous sample is followed up to degree level to ascertain whether or not this is so.

PROCEDURE

The original sample consisted of students from co-educational and single-sex schools who entered four colleges of the University of Wales in 1965-6, 1966-7 and 1967-8 and Swansea 1968-9. It was restricted to those who had taken Welsh Joint Education Committee A-levels and were taking at least one of eight specified subjects at university. These were French, history, geography, applied mathematics, pure mathematics, physics, chemistry and botany. The faculties of Arts and Science were separated and students were divided into four categories or levels according to performance in the Advanced Level Examination. This was done by finding each student's average grade on a scale ranging from 1 for grade A to 7 for fail, and setting cut-off points for the levels at 1·67, 2·33, 3·0 and worse than 3·0. Students sitting twice were given their average grade over both examinations. The maximum possible number of matched pairs of students from co-educational and single-sex schools was obtained from the larger sample, matching being on population of school area (four categories), sex, social class, university institution, and also on average grade, best subject and number of attempts in the A-level examination. Almost all students sat three subjects but where a selected student sat only two he was paired with a similar student. However, in order to obtain a sufficient number of pairs, the exact matching was relaxed after a core sample of 126 pairs had been selected, with the proviso that the difference in one direction for any variable was ' balanced ' by one in the opposite direction. Previous examination of the data had satisfied us that there was little difference between the performance of the different social classes in our sample, and accordingly, the criteria for matching on social class were relaxed a little further. This resulted in a somewhat smaller proportion of the co-educated than the single-sex educated being from the higher social classes. All matching was done using objective rules with the university grades unknown to the matchers.

The degree results of all the students from the 221 pairs obtained were extracted.

RESULTS AND DISCUSSION

Table 1 shows the relative performance of the students in each pair.

TABLE 1

THE RELATIVE PERFORMANCES OF CO-EDUCATED AND SINGLE-SEX EDUCATED STUDENTS AT DEGREE LEVEL.*

		Degree gained by single-sex educated students						
		I	II/1	II/2	III	Pass, fail hon'rs or gener'l	Degree not completed	Total
Degree gained by co-educated student	I	1 *2*	2 *2*	1 —	— —	— —	— *2*	4 *6*
	II/1	1 —	8 *7*	11 *9*	— *4*	5 —	1 *1*	26 *21*
	II/2	— *1*	11 *5*	29 *22*	7 *2*	11 *2*	2 *4*	60 *36*
	III	— *2*	6 *6*	2 *4*	— *2*	2 —	1 *1*	11 *15*
	Pass, fail honours or general	1 —	5 —	5 *2*	2 *4*	5 *6*	2 *1*	20 *13*
	Degree not completed ..	— —	1 —	— *4*	— —	1 *2*	— *1*	2 *7*
	Total	3 *5*	33 *20*	48 *41*	9 *12*	24 *10*	6 *10*	123 *98*

* Figures in the body of the table represent numbers of matched pairs. The Arts faculty are in Roman type and Science faculty in italic type, e.g., there were 11 pairs in the Arts faculty and 9 pairs in the Science faculty in which the co-educated student gained a II/1 and the single-sex educated student a II/2.

The Wilcoxon matched pairs signed ranks test was performed on the data for Arts separately, Science separately and overall. The values were 0·76, 0·08 and 0·52, respectively. None of these remotely approach significance. In fact, Table 1 shows that the total numbers of co-educated and single-sex educated students gaining each type of degree are very similar except that only 9 co-educated as against 16 single-sex educated students fail to obtain a degree of any kind. Most of these drop-outs occur at the end of first year and are already reflected in the results of the previous study.

Thus, the co-education/single-sex education variable, while carrying some weight during school years (Dale, 1970, 1972 and 1974), would appear to have little, if any, association with final degree performance at university. Such effect as there may be at university comes mainly in the first year and may perhaps reflect a slightly less balanced management of social life on the part of the single-sex educated students. If this handicap exists, it seems to disappear for those students who remain at university until they take their degrees.

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RECOGNITION AND INFERENCE IN THE CO-ORDINATION OF PERSPECTIVES

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SUMMARY. Previous research on the child's ability to predict the viewpoint of another has typically used either (*a*) a *recognition* procedure, in which the subject views the model from different perspectives prior to selecting the viewpoint required, or (*b*) an *inference* procedure, in which the subject makes his choice after viewing the model from one position only. An experiment is reported which directly compares the effects of these two procedures, and demonstrates less egocentrism in a recognition than in an inference condition. It is suggested that this distinction can help explain some apparent anomalies in the results of earlier research.

INTRODUCTION

Piaget and Inhelder (1956) have traced the development of the child's ability to predict spatial perspectives other than his own, by seating the child in front of a model of three mountains and asking him to predict the viewpoint of a doll at various locations round the model. Using this procedure, they report a four-stage sequence of perspective-taking skills. In the first stage, the child fails to realise that a view which is different from his own can exist (pure egocentrism). In the second stage, although the child realises that differences in view exist, he is hampered by his own, and is unable to make accurate transformations. By the third stage, the child is aware of differences in perspective and is also able more frequently to predict the viewpoint of another. Support for such a developmental sequence has been reported by Piaget and Inhelder (1956) and Laurendeau and Pinard (1970).

Using more exacting stimuli, Flavell *et al.* (1968) have reported that children's responses can be categorised reliably as fully egocentric or non-egocentric. Further, they were able to make qualitative distinctions between non-egocentric errors of differing accuracy. Despite the variety of tasks which have been devised and purport to measure the *same* perspective-taking skill, there remain wide and unexplained differences in the difficulty level and average age of mastery. For example, at one end of the difficulty continuum are the Picture and Eye position tests described by Flavell *et al.* (1968). In these situations, 2-and 3-year-old children are reliably able to anticipate the viewpoint of another. At the opposite end of the spectrum are the 'three mountains' task used by Laurendeau and Pinard (1970) and the three cylinders used by Flavell. 50 per cent of the 12-year-olds in Laurendeau and Pinard's study and a high percentage of 16-year-olds in Flavell's failed the more difficult sub-tests. Other investigations report ages of mastery at intervals along the continuum.

In considering why such a decalage exists, we examined the exact procedures which had been adopted. The original Piaget and Inhelder experiment presented the model to the child and asked him to make judgments about the view of a doll. He was allowed to walk round the model *only* to check the perspective of the doll. This procedure was also used in the Laurendeau and Pinard study and by Dodwell (1963).

In other investigations, however, the child may be allowed to view the objects from a number of perspectives *before* he is asked to predict the view of a doll. It is argued that in these cases the task is a very different one, requiring the child to *recognise* perspectives rather than infer them. Such procedures have been used by Houssiadas (1965); Fishbein, Lewis and Keiffer (1972) and Brodzinsky, Jackson and Overton (1972). In Houssiadas' study the child was shown two positions other than his own (90° and 180°) by rotating the model in front of him. In the other experiments the child was either able to walk round the model or manipulate it himself. Since the age levels at which egocentrism decreases tend to be lower for the latter group of studies, it is predicted that co-ordination of perspectives tasks including recognition will lead subjects to make fewer egocentric errors than when inference procedures are used.

A second difference between the published investigations is in the position of the doll when the subject has to predict its viewpoint. Some investigators have limited judgments to those at 180° in relation to the subject's own (Shantz and Watson, 1967). Others have used the positions which include left-right and front-back transformations, i.e., 45° and 60° intervals (Piaget and Inhelder, 1956; Aebli, 1967; Laurendeau and Pinard, 1970; Garner and Plant, 1972). It is suggested that some of the differences reported in spatial egocentrism tasks may be attributable to such a position effect. Harris and Strommen (1972) have shown the early development of front-back discriminations, as compared with left-right. There is also evidence from some Soviet psychologists that children who have been forced to spend long periods in bed due to illness show greater decrement in spatial discriminations involving mixed levels of transformation, e.g., ' upper right or lower left ' (Shemyakin, 1959). Consequently, the literature to date was tabulated according to whether the authors had used recognition or inference procedures, and on the spatial position that the child was required to predict. This is summarised in Table 1. Although there are some gaps in the table, it can be seen that those investigations which used recognition procedures reported lower ages of mastery than those using inference procedures. In addition, the lowest age of mastery was reported when the child predicted the viewpoint of another at 180° to himself, followed by 90°, and that the higher age levels reported involved judgments about the intervening positions. The present study was designed to provide further evidence for the importance of these two variables in spatial perspective tasks.

TABLE 1

RESULTS OF THE THREE MOUNTAIN EXPERIMENTS TABULATED ACCORDING TO THE TASK VARIABLES: RECOGNITION/INFERENCE AND DEGREE OF TRANSFORMATION.

(Figures in parentheses are the reported age at which egocentrism declines.)

Degree of Transformation	Recognition	Inference
45°		Piaget and Inhelder (9–11 yrs) Laurendeau and Pinard (10 yrs) Flavell's ' three cylinders ' (12 yrs) Aebli (8 yrs)
90°	Houssiadas (<7·11 yrs) Brodzinsky *et al.* (8–10 yrs) Fishbein *et al.* (7·7 yrs)	Dodwell (9 yrs)
180°	Flavell's Picture Position (2 yrs)	Shantz and Watson (3 to 4 yrs)

METHOD

Subjects.

30 children (15 boys and 15 girls) attending a day school in Bristol, England, took part in this study. All the children were white, and of lower middle class, Catholic parents. Their ages ranged from 6·7 to 8·7 years, mean 7·8 years, and IQ as measured by the English Picture Vocabulary Test ranged from 82 to 117, mean 96·26. The children were all from suburban districts, and were chosen randomly to participate.

Apparatus.

A scene of three mountains, very similar to that described by Piaget and Inhelder (1956, p. 211), was used. The mountains were on a board, 1 metre square, and ranged in height from 12 to 30 cms. In front of the child and a little to his right was the smallest green mountain. To his left was a larger brown mountain with a sheep on the top, and in the middle behind the others was the largest mountain

This was grey with a snow-covered peak and a house on its lower slopes. In addition, there were 10 coloured pictures of the scene. Eight were drawn at 45° intervals from an angle of 30° above the base of the mountains. There were also two ' trick ' pictures, made by interchanging the positions of the mountains.

Design.

All subjects were randomly assigned to the inference or recognition condition. In both conditions they made seven judgments of viewpoint other than their own. These corresponded to (*a*) the back view (180°), (*b*) side views (90°, 270°), (*c*) corner views (45°, 135°, 225°, 315°), and were made in a random order.

Procedure.

In the recognition condition subjects were introduced to the model and then allowed to walk once all round it. They were asked if the mountains looked different as they were walking around. All subjects agreed that they did. They were not asked to explain the differences that they saw, although some subjects spontaneously did so. In the inference condition the subjects were simply seated in front of the model and not allowed to see it from other viewpoints.

Following Fishbein, Lewis and Keiffer (1972), the children were asked to predict the viewpoint of the experimenter as she walked round the scene. All children were first shown the pictures and were asked to choose the one which corresponded to their own view. All subjects did this correctly first time. Then the experimenter moved to the seven other positions in turn, sitting down in each one, and the child chose the picture corresponding to the experimenter's view each time. Instructions to subjects were as follows :

" The other day, I took this model to another school and the children there wanted to draw the mountains. Would you like to see the pictures they made ? Here they are. The children drew the pictures from different places ; some sat round here and others here. (Pointing to back and side positions.) I wonder if you can guess where you would have to sit to draw these pictures ? First of all, can you guess which picture looks like you would draw from where you are sitting now ? . . . Now, I think I am going to take a walk round the mountains. When I stop, can you show me the picture that looks like what I can see ? Show me the picture I would draw if I sat here."

RESULTS

There were no differences in age or IQ between subjects assigned to the recognition and inference groups (mean age 7·8, 7·7 respectively ; mean IQ 100·9, 101·5 respectively). A comparison of egocentric errors between the two groups showed that subjects made more such errors in the inference condition (mean number of egocentric errors in the inference condition=1·4, in the recognition condition=0·67). Comparison of those subjects who never made an egocentric error with those who made at least one, revealed that subjects were more likely to make egocentric errors in the inference condition (recognition : 9 no errors, 6 at least one error ; inference : 2 no errors, 13 at least one error ; $\chi^2=5{\cdot}17$, $P<{\cdot}05$).

A split-plot analysis of variance showed that the position of the experimenter significantly affected the child's ability to identify accurately a particular view. For both conditions, the weighted number of correct responses for the 180°, 90° and 45° positions were calculated. For the 180° position, the score for each subject was multipled by a weight of 4, and for the 90° and 270° positions combined by a weight of 2. The mean number of correct responses are shown in Table 2.

TABLE 2

MEAN NUMBER OF CORRECT RESPONSES AT THE 180°, 90° AND 45° POSITIONS (weighted) AS A FUNCTION OF INFERENCE/RECOGNITION.

	180°	90°	45°
Recognition	1·6	0·8	1·06
Inference	1·6	0·4	0·73

The analysis of variance yielded an F of 3·85, (P < ·05). for the position main effect, confirming our second hypothesis. No other effects approached significance.

DISCUSSION

The child's ability to co-ordinate perspectives as measured by the three-mountain task seems to be influenced both by whether the task is one of recognition or inference and by the position, relative to his own, about which the child is required to judge. The comparative ease of the front-back discrimination was also noted by Piaget and Inhelder (1956) and Flavell *et al.* (1968), and is consistent with the work of Harris and Strommen (1972). However, contrary to prediction, subjects in this experiment were better able to predict a viewpoint different from their own when this was in one of the four corner positions, rather than the two left-right positions. The reasons for this can only be tentative, but it was noticed that the children frequently based their judgments on the positions of the sheep or house, rather than the mountains themselves. The arrangement of the objects used happened to be one in which the position of the house was shielded in the left-right discrimination, and the lack of this clue may have increased the difficulty of the task It seemed that young children had fairly clear ideas of the appearance of sheep and houses from different angles and therefore focused on these in their judgments. This suggests that the co-ordination of familiar objects may be considerably easier than that of the unfamiliar objects. The argument is supported by examining the stimuli used by Laurendeau and Pinard (1970) and by Garner and Plant (1972). Both these investigations used three symmetrical unfamiliar objects, without the addition of animal figures, and both report higher age levels of mastery for the task. Although not manipulated in this experiment, therefore, the familiarity of the stimuli may be another factor which deserves attention.

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TEACHER-PUPIL CONTACT IN JUNIOR CLASSROOMS

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SUMMARY. The nature of teacher contact with children in six informal junior school classrooms was examined using a specially designed observation instrument. This focused on three methods of addressing children (as a class, in a small group and privately on their own) and 19 types of teacher conversation. Private, work-oriented contact predominated, but this was mainly task supervision with relatively little on the substantive content of children's activities. Most substantive contact was low-level and factual.

INTRODUCTION

The swing away from traditional methods of class teaching towards the variety of approaches subsumed by the term ' integrated day ' has been accompanied by a growing interest in the systematic study of classroom processes and the spread of innovation at classroom level. Investigations of the new trends in British primary schools range from exploratory surveys of classroom organisation (Moran, 1971 ; Bealing, 1972) to observational studies of teachers' and children's classroom behaviour (Duthie, 1970 ; Hilsum and Cane, 1971 ; Resnick, 1972 ; Garner, 1972 ; Garner and Bing, 1973)

The purpose of the exploratory study reported here was to examine the nature of teacher-pupil contact in informal junior classrooms in terms of the teacher's *method* of talking to children (Are they addressed as a whole class, in a small group or privately on their own ?) and the teacher's *conversational approach* (What did the teacher talk about ? How did teacher and pupil interact ?) Interest focused on the extent to which the teacher's observable behaviour matched up to the popular image of informal teaching.

METHOD

Observation Schedule.

Six observers (all teachers on a full-time advanced diploma course) were trained to use an observation schedule which had been developed for use in informal junior school classrooms. Every 25 seconds a pre-recorded time signal was fed into the observer's ear from a small cassette tape-recorder and the observer coded the teacher's method and conversational approach at the precise time of the signal. He did this on a specially prepared record sheet by marking one of the three teaching method categories (addressing children as a class, in a small group or privately on their own) and one of the 19 teacher conversation categories. Each of these 19 categories fell into one of six major groups. The groups were based on what the teacher was talking about (task, task supervision or routine matter) and whether or not the teacher was seeking an answer (question or statement). The categories are given in Tables 1, 2 and 3. Examples of the 19 teacher conversation categories are given in the Appendix. At the end of each visit the observer wrote a thumb-nail sketch of the lesson, noting for instance whether there was a single task for all the children and whether apparatus was involved.

The observation schedule has several features in common with other instruments designed for use in informal classrooms. For instance, task questions are broadly comparable to Resnick's ' substantive ' questions and the types of conversation coded as routine are very similar to Garner and Bing's ' procedural ' and ' disciplinary ' contacts. In some respects the schedule's categories are most akin to those described by Duthie (Chapter X). However, the breakdown of conversation related to the substantive content of children's tasks is considerably more detailed.

At the end of the training period the reliability of the observers' coding was assessed using a videotape consisting of five short extracts of teaching behaviour and lasting approximately 20 minutes. The average percentage agreement with the investigator on teaching method was 60 per cent but two observers forgot to code the teacher's method for half the tape and the percentage rose to 75 per cent when their results were omitted. The average percentage agreement with the investigator was 54 per cent on the 19 minor teacher conversation categories and 71 per cent on the six major groups. At the end of the study the observers' reliability was again tested, this time using a 25-minute videotape extract from a single lesson when the teacher was dealing privately with individual children one at a time. The average percentage agreement with the investigator on this occasion was 66 per cent on the minor conversation categories and 76 per cent on the major categories. (One of the six observers was absent for the retest.) Observers reported that coding ' live ' in the classroom was generally preferable to coding from videotape because it was usually easier to see and hear the interaction.

It is pertinent to add that in later reliability trials a different group of eight observers was tested with the original videotape consisting of five short extracts. On this occasion the investigator repeated what was being said at the time of the signal if the utterance was not perfectly clear. The average percentage agreement with the investigator was 76 per cent on teaching method, 64 per cent on the 19 minor teacher conversation categories and 79 per cent on the six major groups.

Data Collection.

The teacher sample consisted of six volunteer junior school teachers working in six different unstreamed city schools. At the time of the study the teachers averaged three years' teaching experience and had an average class size of 31 children. There were three men (teachers A, B, F) and three women (teachers C, D, E), four classes of first or second year juniors (teachers A, B, C and E) and two classes of third or fourth year juniors (teachers D and F). All the children worked at mathematics for the duration of each observational visit and sat informally in small groups. A variety of activities, as opposed to one set task, was generally provided by teachers A, C, D and E. Practical work was most frequently included by teachers A, B, C and E. Teachers C and F set up a streaming situation in miniature within the classroom, teachers A and E set up occasional groups of children of similar ability, teacher D deliberately mixed children and teacher B allowed children to choose their own work place.

Each teacher was visited once a week for the Wednesday mid-morning break to lunchtime period by the six observers in turn. This rotation of observers meant that every teacher was seen once by every observer and that 36 mathematics lessons of approximately an hour's duration were available for analysis (6 teachers × 6 observers = 36 lessons).

Each observer was accompanied on his visit by a second observer who watched children one at a time, in a pre-arranged arbitrary order. Full details of the pupil observation findings are given by Boydell (1975).

DATA ANALYSIS

Teaching Method.

The frequencies of different methods of addressing children were expressed as average lesson percentages. The results are shown in Table 1. A two-way analysis of variance (teachers by visits) showed that the differences between teachers in the frequency with which they addressed the whole class were significant ($F=5{\cdot}68$, 5 df, $P<{\cdot}01$). The coefficient of reliability found by subtracting residual variance from teacher variance and expressing this answer as a proportion of teacher variance was ·82 (Medley and Mitzel, 1963).

Teacher Conversation.

The frequencies of different types of teacher conversation were also expressed as average lesson percentages for each teacher. Three of the minor conversation categories were rarely used (1c, 2b, 5c). By contrast three others accounted for between a third and a half of every teacher's conversation (5b, 5f, 6a). A two-way analysis of variance (teachers by visits) revealed significant variation with 1a ($F=3{\cdot}78$, 5df, $P<{\cdot}01$), 5e ($F=3{\cdot}34$, 5 df, $P<{\cdot}05$), 6c ($F=5{\cdot}02$, 5 df, $P<{\cdot}01$) and 6d ($F=4{\cdot}89$, 5 df, $P<{\cdot}01$). The associated coefficients of reliability for these four minor categories were ·74, ·70, ·80 and ·80, respectively. The average lesson percentages for each of the six teachers were then averaged to give the average lesson profile displayed in Table 2.

TABLE 1

VARIATION IN THE USE OF TEACHING METHODS.
(Average lesson percentages.)

Method	Teacher						
	A	B	C	D	E	F	Ave.
Teacher addresses—							
Whole class or single child in class setting	3	10	10	3	3	14	7
Small group or single child in group setting	24	21	17	9	21	10	17
Single child privately, giving individual attention	74	70	74	88	76	76	76

TABLE 2

AVERAGE INCIDENCE OF THE NINETEEN MINOR CATEGORIES OF TEACHER CONVERSATION.
(Average lesson percentages)

Minor Category	Lesson Average
1. *Task Questions* answered by child—	
(*a*) recalling facts	7
(*b*) offering ideas, solutions (closed—one acceptable answer)	7
(*c*) offering ideas, solutions (open—more than one acceptable answer)	1
2. *Task Supervision Questions* answered by child—	
(*a*) reporting progress	6
(*b*) choosing another task	1
(*c*) evaluating own task	3
3. *Routine Questions* answered by child—	
(*a*) referring to matters of classroom management, behaviour or small talk	3
4. *Task Statements*—	
(*a*) of facts	8
(*b*) of ideas, explanations	3
5. *Task Supervision Statements*—	
(*a*) of written instructions or words or spellings child does not know	5
(*b*) which tell child which task to do or how to do it	15
(*c*) which tell child to choose task	1
(*d*) which grant or refuse task request	2
(*e*) which praise child's work or effort	3
(*f*) which provide neutral or critical feedback on child's work or effort	16
6. *Routine Statements*—	
(*a*) of information, directions, permissions to do with classroom management	12
(*b*) which provide positive or neutral feedback on routine matters	5
(*c*) of critical control	3
(*d*) of small talk	3

The frequencies of the six major types of teacher conversation are expressed as average lesson percentages for every teacher in Table 3. Cross-tabulation of teaching method against teacher conversation revealed that teachers spent approximately three-fifths of their time on private work-oriented contact with individual children (questions and statements to do with the children's tasks and their supervision) A two-way analysis of variance (teachers by visits) revealed significant variation in teachers' use of work-oriented conversation (F=3·48, 5 df, P<·05) and an associated coefficient of reliability of ·71. A two-way analysis of variance was also applied to each of the six major categories in turn. The relatively low incidence of task supervision questions and task statements was coupled to a lack of significant teacher variation (F=·83 and F=·98, respectively). Variation approached significance for routine questions (F=2·41) and task supervision statements (F=1·95). Teacher variation reached significance for task questions (F=2·94, 5 df, P<·05) and routine statements (F=3·55, 5 df, P<·05). The associated coefficients of observer reliability for these two major categories were ·66 and ·72, respectively.

TABLE 3

INCIDENCE OF THE SIX MAJOR CATEGORIES OF TEACHER CONVERSATION

(Average lesson percentages.)

Major Category	Teacher						
	A	B	C	D	E	F	Ave.
1. Task Questions..........	14	6	18	17	16	14	14
2. Task Supervision Questions	10	12	12	8	10	9	10
3. Routine Questions	5	4	2	1	3	1	3
4. Task Statements	14	9	9	9	8	9	10
5. Task Supervision Statements	39	40	33	43	37	52	41
6. Routine Statements	19	30	26	21	26	14	23

Child Contact with the Teacher.

Tables, 1, 2 and 3 show how teachers spent their time. Further analysis was carried out to estimate approximately how much time the average child spent in task, task supervision and routine contact with the teacher, either as the focus of attention or as part of a larger audience. It was assumed that the likelihood of teacher contact was ·03 (one in 30) when the teacher talked privately to a single child, ·10 (one in 10) when the teacher addressed a small group and 1·00 when the teacher addressed the whole class. The estimation of the average child's task contact with teacher F will be taken as an example. Teacher F spent 23 per cent of his time questioning or talking to children about their task (Table 3) and this was made up of 6 per cent class attention, 4 per cent group attention and 13 per cent individual attention. Thus, the likelihood that the average child received task contact in any setting was (·06 × 1·00)+(·04 × ·10)+(·13 × ·03) which equals ·068 and is equivalent to 6·8 per cent total lesson time (Table 4).

The amount of time the average child spent out of contact with the teacher and the incidence of the different types of contact are given in Table 4 expressed as total lesson time percentages. Whereas teachers averaged about three times as much work-oriented contact as routine contact (Table 3) it will be noticed that routine contact figures very prominently in terms of the type of contact the average child received (Table 4).

TABLE 4

INCIDENCE OF CONTACT RECEIVED BY AVERAGE CHILD.
(Estimated total lesson time percentages.)

Situation	Teacher						
	A	B	C	D	E	F	Ave.
Task Contact	1·4	2·6	1·3	1·1	1·4	6·8	2·4
Task Supervision Contact	2·3	7·4	4·0	1·9	3·0	7·2	4·3
Routine Contact	3·9	4·5	8·0	3·8	3·3	2·5	4·3
No Contact	92·4	85·5	86·7	93·2	92·3	83·5	88·9

DISCUSSION

The results of this exploratory study showed that talking to children privately, one at a time, was far and away the most popular teaching method and in accord with the Plowden Report maxim that " any class, however homogeneous it seems, must always be treated as a body of children needing individual and different attention " (para. 75). But what of teachers' classroom conversation ? Despite the fact that approximately three-quarters of this conversation was work-oriented, only a quarter was directly concerned with the substantive content of children's activities (task) and even then most of the substantive contact was of a low cognitive order, consisting of questions answered by recalling facts (1a) and factual teacher statements (4a). Higher level cognitive contributions involving ideas, explanations or problems (1b, 1c and 4b) only accounted for about one-tenth of the teachers' total conversation. Garner and Bing (1973) have suggested that the low levels of cognition might be due to the time pressure caused by the high incidence of teacher contact with children. Task supervision accounted for the remaining half of work-oriented comments and consisted largely of comments which told the child what to do or how to do it and evaluative remarks about the child's work (although praise was rarely recorded). Matters of classroom routine figured as prominently in the teachers' conversations as contact concerned with the substantive content of children's work. Relatively high measures of non-work activity have also been reported by Hilsum and Cane (1971) and Garner and Bing (1973).

The image of the teacher's role which emerges here may be somewhat at variance with the popular view of the informal teacher who stimulates children to formulate their own ideas, probes and extends their level of understanding by detailed questioning, praises their efforts whenever appropriate and refrains from using simple directives, preferring, in the words of the Plowden Report "to collaborate with children, to lead from behind " (para. 875).

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APPENDIX

Listed below are examples of the 19 conversation categories which were given in Table 2:

1. *Task Questions.*
   (*a*) 'Do you remember what this piece of equipment is called?'
   (*b*) 'Five and five make?'
   (*c*) 'There are lots of ways to work it out, what do you suggest?'

2. *Task Supervision Questions.*
   (*a*) 'Have you finished this work card yet?'
   (*b*) 'Which question would you like to try next?'
   (*c*) 'Are you sure that is the right weight to use?'

3. *Routine Questions.*
   (*a*) 'Have you closed the far window?'

4. *Task Statements.*
   (*a*) 'This is called a lever balance.'
   (*b*) 'That wheel spun faster because it was smaller.'

5. *Task Supervision Statements.*
   (*a*) 'It tells you to draw a block graph next.'
   (*b*) 'Weigh this bag of marbles first.'
   (*c*) 'Decide which question you'd like to do next.'
   (*d*) 'Yes, you can try the problem that John is doing.'
   (*e*) 'Very well done, that work's a big improvement!'
   (*f*) 'No, that answer's not quite right.'

6. *Routine Statements.*
   (*a*) 'There's a pair of scissors on every table.'
   (*b*) 'Put the ruler back where it belongs, not there.'
   (*c*) 'Stop this playing around at once!'
   (*d*) 'It's Andrew's birthday today.'

BOOK REVIEWS

BANKS, O., and FINLAYSON, D. (1973). *Success and Failure in the Secondary School: An Interdisciplinary Approach to School Achievement.* London: Methuen, pp. ix+259, £3·50.

Why do children do well or badly at school? In answer to this question, Banks and Finlayson believe that too often we have had studies that reveal statistical relationships, but which provide us with no understanding of causal sequences. Such an understanding, they argue, can only follow from study of the relationship between social structure and personality. And this, they consider, demands an interdisciplinary approach in which the psychologist and the sociologist co-operate to study " the process of school achievement." This book is the outcome of such co-operation on such a theme. The authors also accept " the present educational situation " for the purposes of research, arguing that social scientists must concern themselves with what is rather than with what ought to be. They consider, however, that understanding of what makes for success at school is important in a society valuing achievement.

Banks and Finlayson chose for study boys attending three schools : a traditional grammar school, a technical grammar school, and the academic block of a comprehensive school. The sample was made up of the first-year intakes, and these boys were studied up to their taking the GCE and CSE. This main sample was further sub-sampled. One important sub-sample was made up of boys categorised by the researchers as ' successful ' and ' unsuccessful.' Boys were placed into either of these two categories on the basis of the extent to which their school attainment was greater or less than might have been predicted from their 11-plus results.

Throughout the study Banks and Finlayson are at pains to point out its limitations. These they see as the small size of the sample, the lack of randomness in the selection of the major sub-sample, the questionable representativeness of the schools selected, and the general homogeneity of the sample with respect to socio-economic factors and sex. The very disparate nature of the data presented problems of analysis. The authors, therefore, make no great claims for either the validity or reliability of their findings. They see their study as concerned with the discovery of *probable* patterns of relationship.

The authors, however, consider their research provides some evidence that " love-oriented techniques of discipline " in the home, rather than other techniques, may result in success at school. And their findings suggest that parent/child relationships were more important than factors of a socio-economic nature in explaining why some working-class parents' sons were more successful than those of other working-class parents. The authors also argue that the schools play a greater part in school success than is currently thought.

In turn Banks and Finlayson have been successful in writing a book which the non-specialist, with an interest in educational research, can read without bewilderment. It may be hoped that educational researchers will take up the challenge of this book and further explore some of the patterns of relationship which the study uncovers.

B. SHAW.

BOWLBY, J. (1973). *Separation Anxiety and Loss, Vol. 2 of Attachment and Loss.* Vol. 95 of the International Psycho-analytical Library. London : Hogarth Press and the Institute of Psychoanalysis, pp. 444, £4·50.

Although this book is the second volume of *Attachment and Loss*, it will be reviewed here as far as possible as a single volume. The aim of the work as a whole was to try to understand how and why disturbances of the infant child relationship produced the effects early noted by Bowlby. While Volume 1 was largely concerned with the nature of the child's tie with his mother, Volume 2 deals with separation anxiety in all its manifestations. Thus, among the 22 chapters we find discussed behaviour in the presence and absence of mother among humans and among primates, situations that arouse fear in humans and in animals, the importance of projection, overdependency, childhood phobias, and agoraphobia. This selection of topics indicates clearly that Bowlby has come a long way from orthodox psychoanalysis. Certainly much use is made of animal studies and ethological findings.

Bowlby's approach raises some misgivings in this reviewer. In the first place he assumes the truth of ethological observations and the applicability to man in a cavalier way—especially since they are the cornerstones of his arguments. For example, " Whether suddenly alarmed or chronically anxious, whether temporarily comforted or steadily confident, *the way a man or woman thinks or feels is determined in significant degree by the strong genetic biases to respond unthinkingly to the natural clues* " (our italics). This statement surely goes far beyond the evidence. Related to this freedom of extrapolation from animal to human being, an inevitable concomitant of the decision to use ethological concepts, is Bowlby's acceptance of the findings. We rarely see a discussion of the methodology of the investigations or the accuracy of the conclusions in the light of the data. Thus, although there are full reviews of the literature of the various topics Bowlby discusses, these are lists of findings without reference to the quality of the investigation.

Another point also raises queries—this concerns the data gathered by Bowlby and his clinical research team at the Tavistock. This, of course, is not a new objection. It is simply questionable whether observational data are sufficiently objective to form the basis of scientific theorising or not. Thus, for example, in the chapter on the prototypes of human sorrow we find statements such as " all but one made a desperate attempt to avoid the observer " or when he (the observer) walked towards her, " a very worried look came over her face." The correctness of these interpretations is not the question, it is rather the fact that they are interpretations rather than observations.

These doubts have been raised because readers will have to have all their critical faculties working hard to avoid being convinced by Bowlby's arguments lavishly supported by references to empirical studies of men and animals, psychoanalysis and ethology. This is a first-class, well-written, well-argued and carefully documented book—essential reading in the field of child psychopathology and a fine tribute to Bowlby's work over the years.

PAUL KLINE.

CHANAN, G. (Ed.) (1973). *Towards a Science of Teaching.* London: N.F.E.R., pp. 141, £3·15.

In the United States much effort has been devoted to the study of classroom interaction during the last forty years. Such pioneering studies as those of Anderson (1937), Withall (1945), Bales (1950), Flanders (1963) and Amidon (1970) have been followed by such a massive outpouring of research activity that we now have an encyclopaedic catalogue (Simon and Boyer, 1967, 1970) of observation systems. By 1970 the anthology of classroom observation instruments covered 92 different systems or instruments and occupied 17 volumes. As British interest in this area of research has been slow to gather momentum new publications which draw attention to its promise may be welcomed.

Gabriel Chanan has edited a small book which aims to draw attention to the study of classroom interaction by disseminating research findings which he believes are new, important and interesting. The book consists of a selection of five articles which widely vary in length, quality and style of presentation. The first article by

Graham Nuthall and John Church explores the possibility of undertaking controlled experiments in classroom settings. The authors seek to make explicit the assumptions underlying research in which a conscious effort has been made to develop experimental methods which are responsive to classroom complexities. The complex analytical procedures necessary to produce systematic accounts of teacher-pupil interactions are also usefully illustrated by a series of studies described in the later contribution by Gilbert De Landsheere. Although the abstracts of the projects are highly condensed, the description of the author's category system will be of considerable interest to British researchers. Whilst the succinct presentation of material in this article is in many ways admirable, the bald presentation of many results might have been rendered even more meaningful by the inclusion, perhaps by way of summary, of a final discussion section.

The main themes of the paper produced by Margot Cameron-Jones and Arnold Morrison are the implications for teachers and their trainers to be discovered by the study of assessment. A detailed report is provided of the assessment behaviour of seventeen Scottish teachers (eight men and nine women) chosen from six comprehensive schools. Data are rigorously analysed to provide simple descriptions of teachers' assessment behaviour, to assist the study of cross category effects and to facilitate process-product searches which yield patterns of hypotheses.

Some fifty pages of the text are devoted to Ted Wragg's study of the personalities and teaching practice behaviour of 153 graduate students who entered a university department of education in 1969. This paper provides only limited support for the editor's claim that new and important findings emerge in his book. In the discussion of the research context the teachers' salary bill for 1963 is used as an example, whilst the author chooses to illustrate gaps in the existing literature by reference to the 1963 Yearbook of Education. A fuller account of the research study and results is already available in the original thesis (Wragg, 1972).

In view of the vast number of studies undertaken in recent years in the United States, the choice of the final article in the book is particularly curious. Norma Trowbridge briefly reports in half a dozen pages a study which aimed to investigate the extent of differences in teacher self-concept, the relation between teacher self-concept and the kinds of thinking teachers use, the relation between teacher self-concept and the amount of time spent in non-thinking activities, the relation between teacher self-concept and the amount of time teachers allow to talk, and any possible difference between elementary and secondary teachers. As the author admits, self-concept research presents a bewildering array of research methods, testing instruments, hypotheses and definitions. However, the measurement of a teacher's self-concept "was found to be not too difficult," in this study as the Tennessee Self-Concept Scale was available. The specific dimension of teaching performance investigated (by means of an instrument designed by Aschner and Gallagher (1962) was "the kinds of thinking processes" used. The sample of 56 secondary teachers and 302 elementary school teachers (drawn from the central United States) taught classes in urban or rural schools which contained children from a diversity of ethnic backgrounds and income groups. The results of the study suggested to the author that much may be learned about the way a teacher works if we obtain a measure of her self-concept. Unfortunately, such measures may not be used in selection procedures as a "free, honest and responsible report is essential to self-inventory self-concept measurement." Had it been possible for the author to provide further clarification of the theoretical background to the study, to give more information about the sample, and to extend the discussion of the analysis, the report might have been more helpful.

The articles contained in this book emphasise the point that so little is known about the relationships between teachers' classroom behaviours and children's learning that it is currently very difficult, perhaps impossible, to design effective programmes for the education of teachers. It seems likely that the future will witness in Britain a considerable increase in the number of classroom studies and that a wider range of observational systems will be used. In view of the existing serious instrumentation problems, American experience would seem to suggest the advisability of using a variety of instruments in each study to search out the sets of variables which may be significantly related to outcome measures. The mere collection of vast amounts of data will not bring the certainty of greater understanding and the essential challenge will remain that of developing theories of classroom learning. This book contains much of value. It is unfortunate that the articles vary so much in quality.

DONALD E. LOMAX.

CRONBACH, L. J. C., and DRENTH, P. J. D. (Eds.) (1973). *Mental Tests and Cultural Adaptation*. The Hague : Mouton, pp. xi+495, cloth 42 guilders, paper 31 guilders.

This is a collection of 50 papers which were presented at a NATO sponsored conference in Istanbul in 1971. The papers are divided into eight sections dealing with the following problems : (1) Testing in its social framework ; (2) Cross-cultural research strategy ; (3) Testing procedure ; (4) Testing devices ; (5) Educational intervention and educational influence ; (6) Correlates and determinants of test performance ; (7) Factor analytic studies ; (8) Technical issues and prospects. Thus the entire field of testing and selection is well covered, although certain subjects and geographical areas are better represented than others, and observations obtained from and related to ' developing ' countries dominate. Some of the papers provide glimpses of data more fully presented elsewhere. (This is the case with Poortinga's short paper, presenting again some of the data available in his *Psychologia Africana Monograph*, which deserves to be more widely known.) On the other hand, some papers (e.g., Reuning's report of researches on Kalahari Bushmen) present data which have not previously been published in English. The scope of the papers varies, from theoretical discussions (e g., Biesheuvel on "Adaptability : its measurement and determinants," and Irvine and Sanders on " Logic, language and method in construct identification across cultures ") to descriptions of applications of very specific tests (e.g., "Application of D 48 test in Turkey " by C. Kagitcibasi, or "Application of Progressive Matrices in Iraq " by Dhia Abdul-Hubb).

Over three-quarters of the papers deal specifically with cross-cultural issues. Of these about a third are concerned with application of tests and testing methods, now hallowed by usage in Western setting, to non-Western populations in general. The remaining papers deal with related problems in various parts of the globe ; in Africa, Oceania and Asia. Europe is represented by Turkish and Greek Studies. There is a notable lack of specifically South American work although South Americans participated in the conference. (There seems to be, for no apparent reason, less psychological work of this kind done in South America than in Africa, though one would think that her population and problems would offer at least an equal challenge to psychologists.)

Such variety and the lack of cross-references (although Cronbach's and Drenth's " Summary and commentary " and editorial notes go some way to alleviate the latter defect) make this volume into a work of reference suitable for an educational or occupational psychologist involved in testing and selection rather than into a textbook. It provides a richness of ideas, none of which might be immediately applicable to a situation at hand, but many of which, *mutatis mutandis*, may prove very useful. The book can have yet another purpose : it can be used as a collection of readings in cross-cultural studies, dealing both with the above problems and the broader issues of cognition and perception.

J. B. DEREGOWSKI.

D'ARCY, P. (1973). *Reading for Meaning*: Vol. 1, *Learning to Read*; Vol. 2, *The Reader's Response*. London: Schools Council and Hutchinson Educational, pp. 307 and 265; £3·50 each.

This is the report of a survey, carried out for the Schools Council, of "recent research into the reading responses of children from the pre-reading to the post-sixth form stage, and of the methods by which reading is 'taught' in our infant, primary and secondary schools." The book is intended to be of use to practising teachers who might not have the opportunity to find out about research projects in reading at first-hand. The author makes no claim to provide a comprehensive survey, nor, as a teacher of English, does she claim to be an expert in all the aspects of the teaching of reading to which she refers in the book. She states that her aims were to provide some information about recent major research relevant to reading activities in school, to give some idea about the range of opinions about the teaching of reading, and to raise questions such as "which factors are crucial in a child's experience if he is to break the code of written language successfully at an early age?"

The survey has been split into two volumes: one on learning to read, which seems to deal almost entirely with the infant or primary school, and one on the reader's response which deals mainly with secondary and post-sixth form pupils. This is an unfortunate dichotomy, neglecting as it does the children who are learning to read in the secondary schools and the reading response of readers under 10.

The author seems to have been overwhelmed by the amount of material that exists relating to the teaching of reading at the early stages and has elected for a large part of the first volume to give fairly detailed summaries of some of the important research projects. It would be easy, and unfair, to point to investigations that she has missed out—in most cases the points have been covered. However, two omissions seem to the reviewer to be necessary to mention—the research by Jessy Reid and later by John Downing on what young children think about reading, and the important contribution of the psycholinguists to our understanding of reading by the learner and by the mature reader (much of it published by 1970 when this survey was completed).

The chapters on factors in learning to read and on the various methods, devices and reading schemes available to teachers are interesting and should be of use to teachers, although almost inevitably, given the gap between finishing the survey and publication, the picture they give is not completely up-to-date (for example, the Talking Page is no longer produced in this country).

In the second volume, dealing as it does with older children, she seems on much firmer ground and this volume consequently flows more surely. She opens with a discussion of the various models of teaching English and a large part is concerned with investigations of the techniques of analysis and assessment of comprehension, literary appreciation and readers' responses which highlight the many difficulties of such assessments.

One chapter has been devoted to various surveys of children's reading preferences and one to "causes of misunderstanding." This chapter, and the summary of the Kent surveys in the first volume, provide the main treatment of reading failure in the two volumes. Much, of course, is implicit in the discussions on factors in learning to read, yet one could wish for a discussion of methods of helping children with reading difficulties.

There are one or two minor criticisms—it would have been kinder to the reader if, in the references, the books which were published after the survey and hence not mentioned in the text could have been listed separately (and the reviewer was unable to find all the references mentioned in the text). Also, with respect to the reading readiness tests listed in Volume 1, some indication of the appropriateness of the tests for children in British schools would have been helpful, as would an indication of the availability of the tests to teachers (the ITPA, for example, is supposed to be restricted to qualified users).

This is a difficult book to assess—one can only have admiration for the author in tackling it on her own—yet, for it to have been useful to most teachers it would have been better to have had an experienced primary teacher *as well as* the experienced secondary teacher. As it is, the survey is undoubtedly stronger on the secondary side. Secondary teachers (and those teaching students above sixth form level) will find much useful information and a point of view that it is possible to argue with—the author favours the 'personal growth' model of teaching of English. Primary teachers, on the other hand, although they too will find useful information, will find no such connecting point of view. It is unfortunate that the book is so titled as to make it less obviously applicable to the secondary teacher.

JENNIFER STEWART.

DAVIS, G. A. (1973). *Psychology of Problem Solving: Theory and Practice.* New York: Basic Books, pp. 206, £3·80.

The author states his goal as providing " a state-of-the-art overview of research, theory, principles and procedures of creative problem solving." In pursuing this goal he has written two quite distinct units, one dealing with the experimental psychology of problem solving, the other with the technology of promoting creative thinking in various sectors of industry, commerce and education in the United States.

A brief 'Orientation' section introduces the reader to the area of study, and attempts to define creative problem solving. There is a useful summary and evaluation of previous efforts, leading to a definition in terms of (*a*) the stimulus situation, and (*b*) the subject's motivational state. Curiously the remainder of the text refers to specific problem situations in terms of their desired outcomes. This leads the reader to speculate as to whether the formal definition might also have been better achieved from the other end of the process.

Following the introductory section is the first main unit of three chapters dealing with 'Cognitive and Gestalt Views of Problem Solving,' 'Problem Solving to the S-R Psychologist,' and 'Computer Problem-Solving Models.' The treatment of these chapters is somewhat cursory, and possibly well-suited to the intelligent lay reader, or early student. 'The psychologist' and 'the educator' (two of those for whom the text is specifically written) may find them rather unsatisfying.

The second unit, comprising six short chapters, describes a variety of techniques which have been applied in industry and education to develop creative problem-solving skills. There are details of 'Inquiry Activity,' 'Brainstorming,' 'Attribute Listing,' 'Morphological Synthesis,' 'Idea Checklists,' 'Synectics' and 'Bionics,' as well as the Winsconsin project for elementary and high school children, with which Davis is personally connected. Whilst this part of the book is, as the author admits, only loosely connected with the more theoretical part, is is more unusual and of greater interest. Readers who are disenchanted with the formal experimental approach, or who thirst after 'relevance' in their course content, will find this latter part invaluable. It can also be recommended to those of a more eclectic disposition.

The volume has two appendices listing the nature and sources of a great many tests, both commercial and non-commercial. It also contains a full, though almost exclusively American, reference section. One minor irritant is the use of notes and comments placed at the ends of chapters. Some of these cover matters of substance which should have been included in the body of the text.

GEOFFREY BROWN.

GARDNER, H. (1973). *The Arts and Human Development.* London: John Wiley, pp. 19+395, £6·50.

One could consider this book by trying to make out a balance-sheet for it. On the credit side it shows evidence of a keen intelligence in the author, wide knowledge and extensive reading of everything which might seem relevant enough to be woven into his text. It is fluently written and very readable. To the reader not already acquainted with the wide range of psychological ideas and data presented in it the book will be illuminating and lead to much thought. Its text is not marred by inserted references or footnotes, but there are 32 pages of notes at the end in which the sources of material in the text are given.

In brief, the author seeks to use the study of the arts and human activity in relation to them as a means of elaborating ideas on developmental psychology which he feels neglected, as for instance by Piaget, whose work he regards, rightly or wrongly, as predominantly focused upon intellectual or scientific development. He does this by viewing the work of art from four points representing participants round a circle—the artist or creator, the performer, the audience member and the critic. Human development he approaches as involving three systems interrelated but distinct, namely, making, feeling and perceiving. The author, in dealing with these points of view and these systems, reveals a wide catholicity of outlook. He is able to integrate many rather diverse aspects of psychology which some authors would find incompatible. All these points on the credit side make the book a very worthwhile one for the reader.

On the debit side, the book tells us little that is new. We are interested to find familiar ideas and data woven into such a well-designed texture. The book is mainly a good piece of cooking, but to one who has not already tasted most of its material it will be exciting.

As a guide for the reader such a book is not entirely satisfactory. The great danger in such books is that the student does not go to the original sources, and hence education becomes a second-hand affair. But who has time to do the vast reading which Howard Gardner has done for him? However, one small point, which happens to interest the reviewer, could be used as an illustration. In writing on art therapy Gardner has read some relevant books, including one by Margaret Naumburg who writes from a background of penetrating insight, and first-hand contact with her patients. Howard Gardner makes his pronouncements from an arm-chair, although certainly within viewing distance and ear-shot of what is going on. And this is the trouble all through. It is an art-chair book, in the reviewer's opinion.

Does the balance-sheet show a significant difference of credit or debit? That is for the reader to decide.

R. W. PICKFORD.

HASLERUD, G. M. (1972). *Transfer, Memory and Creativity.* Minneapolis: University of Minnesota Press, pp. x+179, £3·70.

The subtitle of this book, 'After-Learning as Perceptual Process,' indicates the author's approach to his attempt to relate the processes of transfer, memory and creativity. His initial point is that it is not so much the acquisition side of learning that is relevant in this context but what happens subsequently, i.e., storage, retrieval and remembering which, like Bartlett, he regards as essentially a reconstructive process. The dynamics are discussed in terms of a number of constructs of which the central one is the Theatre of Perception where there are no actors but all the action takes place. Retrieval-sets Haslerud holds to be of crucial importance. Motivated by the organism's needs, searches for information are directed in centripetal loops to the environment and to a Wundtian Apperception Mass from which feedback returns to the Theatre. It is here that integration occurs. Literal transfer, to use Haslerud's term, is essentially the direct use of information retrieved from storage in the solution of new problems : true or ' creative ' transfer on the other hand involves the generation of new alternatives sought by centrifugally scanning from the different perspective of a projection into the Perceptual Future. This is a construct of the relationships among memory whorls in the interstices of the Apperception Mass. The neologism Projecscan is Haslerud's label for the process. Precisely what all this means is not easy to understand even though these structures and processes are represented in numerous complex and meticulously drawn diagrams.

Having expounded his new perceptual theory, Haslerud goes on to consider its educational applications. He is convinced that the development of creative transfer and therefore of the Projecscan process is an important educational aim and that different kinds of memory and retrieval skills are needed by modern man. He suggests in very general terms how these abilities may be fostered and taught but there are no detailed suggestions as to how this should be done. However, as the author says, " Fundamentally this is a book of theory with most of it awaiting future tests." Certainly he throws out plenty of research suggestions for testing his hypotheses : one would be hard put to it to plan an experimental attack on some of them.

Trying to translate Haslerud's terminology into more familiar terms, one is left with the impression that there is little really new in this theory—though that little may be important. Of course, we have come a long way from Thorndike, Judd and the Gestalt psychologists but the problems of transfer and how to achieve it remain elusive. Readers will find that this book which draws upon research from varied areas of psychology has a distinctly unusual flavour about it ; study of the problems and relationships discussed from a new perspective may well prove stimulating but saccadic scanning of the pages will not be adequate.

A. H. D. TOZER

KERLINGER, F. N., and PEDHAZUR, E. J. (1973). *Multiple Regression in Behavioural Research.* New York : Holt, Rinehart and Winston, pp. 534, n.p.

It might seem surprising that so large a book should be devoted to the topic of multiple regression analysis for psychologists unless one believes, with the authors, that this will be the cornerstone of modern data analysis in the behavioural sciences Their justification is that anything involving the linear model may be regarded as regression analysis and most forms of parametric multivariate analysis involve fitting a linear equation. This leads the authors to regard multiple regression as the basic technique of analysis of which other forms are all special cases.

The main part of the book is concerned with standard multiple regression analysis and analysis of variance and covariance. Discriminant function analysis, canonical regression analysis, multivariate analysis of variance and factor analysis are dealt with in less detail. Much space is devoted to the consideration of both real and hypothetical applications of the techniques being covered. This is useful as it illustrates the interpretation as well as the mechanics involved.

In the case of the analysis of variance there are good reasons for introducing the topic in the traditional manner. Partitioning variance into different components and presenting them in a summary table together with tests of the appropriate null hypothesis is probably easier to understand than the regression approach. It also conveniently leads to consideration of more complex designs and random effect models. This is not to say that the relationship between analysis of variance and regression analysis should be ignored. Students should be aware of the linear model underlying analysis of variance. For one thing, this might lead to a closer examination of the residuals which give information on the adequacy of the overall analysis.

Two roles are attributed to regression analysis, namely that of prediction and explanation. Its value in prediction and description of data is generally accepted. However, despite the attempts of communality and path analysis the use of multiple regression analysis in explanatory theory building is much more open to question.

Since this book has been designed primarily for psychologists, it has been written in an informal manner. This makes for easier reading but great length and the destruction of some of its value as a reference text. The work is ideally suited to being the main text in a course on regression analysis for psychologists at an intermediate level. Few such courses exist or are likely to in the near future. The alternative use is as background reading in an advanced statistics course for psychology undergraduates and other social science students. Used in this way, it may give the student a greater understanding of the techniques involved. As the main text in such a course, however, it might give rise to a rather unbalanced knowledge of the methods of multivariate data analysis.

R. R. MACDONALD.

KLEIN, R. D., HAPKIEWICZ, W. G., and RODEN, A. H. (1973). *Behaviour Modification in Educational Settings.* Springfield, Illinois : C. G. Thomas, pp. 552, $14·95.

Teachers frequently complain that the courses in educational psychology and child development they attended during training did little to prepare them for the problems they were to encounter in practice. If pressed, they may grudgingly concede that the content was often interesting and occasionally useful in suggesting possible explanations for children's behaviour. However, what they really needed was a psychologically based teaching method which would have allowed them to approach their various classroom difficulties in a consistently professional way.

This, of course, continues to be a somewhat tall order, but an increasing number of educationalists and psychologists now believe that the basic framework for a scientific pedagogy exists in the concepts of behaviour modification. And, following encouraging results from a large number of applications of the method with exceptional children they propose that systematic use of behaviour modification techniques should be extended throughout education.

Behaviour Modification in Educational Settings is one of a number of recent books of readings produced with this in view, its aim being to provide educationalists and other concerned professionals with a wide range of examples of the application of behaviour modification techniques by teachers. The contents, heavily biased towards operant methodology, consist of 33 articles and papers from the last decade organised into four sections :

(1) Operant principles in education.
(2) Respondent principles in education.
(3) Teacher training.
(4) Issues and problems.

Section One includes 23 items representative of : the rationale and methodology of behaviour modification (four) ; and applications with pre-school children (six) ; school age children (seven) ; special education (four) ; brain damaged and retarded children (two). Section Two contains an introduction to the use of respondent conditioning concepts in classroom situations. This is followed by a selection of five varied examples of the application of desensitisation procedures. The concluding sections each contain two papers. Section Three has previously unpublished accounts of in-service teacher training workshops and teacher consultation projects.

In Section Four some issues and problems in the use of token economies are discussed and a final paper reviews some limitations of the behaviour modification paradigm.

The main strength of this book lies in the variety of its content through which emerge, in somewhat haphazard way, some of the more important technical issues in the use of behaviour modification techniques. The materials are readable and informative and there is an interesting variety of problem areas, techniques and target children. However, as might be expected, there is some variability of quality; influential and well-known articles such as those of Bijou, Peterson and Alts' "A method to integrate descriptive and experimental field studies," and Kuypers, Becker and O'Leary's " How to make a token system fail," co-exist with previously unpublished work of moderate sophistication. Having encountered many of the articles previously this reviewer was intrigued by the unexpected inclusion of a number of respondent studies. These undoubtedly repay study, as indeed does the section on teacher training. The section on school aged children will also be of considerable interest to those engaged in the training and support of teachers as behavioural change agents.

However, the reviewer was conscious that many aspects of the current application of behaviour modification techniques are rarely, if at all, mentioned: the use of Premack's principle; self reinforcement; punishment and problems of stimulus and response generalisation. Moreover, the editors' concentration upon articles written round 1967-68 means that much of the content is concerned solely with demonstrations of experimental effect; this antedates moves to integrate behaviour modification strategies into a systems analysis approach such as that of the Brickers in their language programmes for the mentally retarded. " Behaviour Modification in Educational Settings " is attractively presented, acceptably organised and well worth having as a book of source materials. However, those seeking to consult a really comprehensive and up-to-date treatment of the topic will do better elsewhere: for instance, the superb 1973 issue of the Yearbook of the National Society for the Study of Education.

J. WARD.

LANDAU, E. D., *et al.* (Eds.) (1972). *Child Development Through Literature.* New Jersey: Prentice-Hall, pp. xi+520, paper £3·00.

It is no secret that if one wants to participate most fully in the experiences of an individual an ideal way is through personal documents, such as diaries, autobiographies and the like. Such a method has at once the advantage of recording inner experiences and viewpoints and the drawback of observing the reactions of others to the self solely through the eyes of the individual concerned. In contrast the novel or short story enables one to experience the inner world of a person while also being in a position to observe how others react to him in a more objective way. So far as children and their development and problems are concerned, a literature of diaries and other documents does exist as well as numerous examples of narratives in the form of novels and short stories. The editors of this publication have hit upon the notion of drawing together selected portions of literary output concerned with children's development, of using these to stimulate interest in child study students, and of linking these directly with the treatment of the same facets of development by psychologists and educationists.

It is a book of selections, divided into categories, and cross-indexed with most of the standard books on child development. The appendix contains a list of the topics covered and the literary selections which accompany them. Among these topics are early infancy, the toddler, early conditioning, personality development, sex role, independence and coping, the concept of self and such emotional states as love, fear, intellectual development, communication, play, the handicapped child, the influences of home, school, race, status and culture. The range is wide. For those who wish to enlarge their knowledge of children as presented in (mainly) American literature, the literary selections are in themselves of interest, one of the most telling being that from Enid Bagnold's *Book of Life*. And it is clear that one of the objectives of the book—' to help students to catch the colour of life itself ' is attained.

Each literary extract is followed by a short discussion, which is more in the nature of a summary of points raised in the extract, and this in turn is followed by suggested springboards for enquiry. These, however, are rather short and the value of the extract must rely to a very great extent upon the skill of the teacher, whether in a school setting or in an institute of education. The approach as laid out here is rather naive. It may be successful, however, with students in colleges of further education, night classes of one sort or another, or even in sixth form classes in school, as an initiatory device to arouse interest in the field and to sustain that interest through considering the inter-relatedness of data about children obtained by such different methods as those of the perceptive writer and the scientific worker.

GERTRUDE KEIR.

MILLER, G. R., and BURGOON, M. (1973). *New Techniques of Persuasion.* New York: Harper and Row, pp. 120, £1·25.

This little book is of interest at several levels : as a review of a research field, as a set of helpful hints for day-to-day social interchange, and as an illustration of the ethical problems which can often face practical psychologists. Some comments at each level are therefore required.

The research field which is covered is part of what textbooks commonly refer to as attitude change, though it might also appear under social influence, conformity, communication or cognitive consistency. The field is clearly a central one, but the prodigious research output of social psychologists (especially the American ones) has caused most other people to withdraw in overwhelmed confusion. The book deals with two main aspects of this research, the generalised case of role-playing and the more specialised instance of counter-attitudinal advocacy. (If you say that to yourself a few times, the term soon becomes surprisingly familiar.) As one of the overwhelmed observers of this field who had given up hope of mastering its more recent complexities, I must report a satisfying outcome. The main features of McGuire's model, ' late ' as well as ' early ' dissonance interpretations, incentive theory and the rest are now much clearer to me.

The book is clearly written, but you have to tolerate the authors' extensive jargon. Thus, role-playing is distinguished from other attitude change approaches as follows : " Rather than encoding messages to relatively passive persuadees, the persuader induces them to encode the messages themselves : in a sense, persuasion occurs because the persuadee acts upon himself, instead of being acted upon by the persuader " (p. 6). Counter-attitudinal advocacy is role-playing of a more limited kind, when specific assertions are required from the persuadee (I tried to find a better word ; the authors deserve sympathy after all).

In practical terms we are all involved in persuasion attempts from time to time ; the successful trade union official, manager, teacher, psychotherapist, suitor or educational psychologist is the one who can persuade others to accept what he believes is right. On the second level of review this book is addressed to the " fledgling practitioner of persuasion " (p. vii). Even the more fully-fledged amongst us will find some of its practical suggestions worthy of consideration. I was, however, particularly troubled by a central problem : granted that people are likely to believe an opposing argument if they can be induced to advocate it themselves, how do we get them to advocate it in the first place? The old-style (I hope) sergeant-major had one method. "You are a 'orrible little man. (Pause) What are you?" But this approach will not get the educational psychologist very far as he exercises his persuasive charm on a reluctant teacher or parent; anyhow, we are reminded (p. 29) that behaviour performed under little pressure or for small reward is likely to be persuasively the more effective. (Come to think of it, how did I become committed to writing this review?) Unfortunately, the authors help us not at all with this crucial problem.

The third level of review is in terms of value issues. We are all in the persuasion business, yet a cold-blooded analysis of the process can be disturbing. For example, Chapter 2 of this book describes "how to plan a persuasive attack designed to induce resistance to later persuasive appeals" (p. 20). Elsewhere we are exhorted "to arrange the situation so that the persuadee believes that he is communicating with an uncommitted audience" (p. 98); and since "some people are certain to be more concerned than others about the ethical consequences of lying . . . the persuader should undertake careful individual analysis of the intended persuadee" (p. 68). All very plausible in one respect, yet requiring a more thorough ideological examination than the authors provide. The final section of the book does indeed pose problems of this kind, but the analysis is a superficial one, justified on the grounds that having made explicit some of the ethical issues the authors can leave the choice to their readers.

In summary, this is not intended to be a major piece of original work. As a brief interpretation of a complicated and important field it is worth reading. It is a book which made me think, but not always along the lines intended.

PETER WARR.

MITTLER, P. (Ed.) (1973). *Assessment for Learning in the Mentally Handicapped.* Edinburgh: Churchill Livingstone, pp. x+313, £5·50.

This book records the papers and discussions of a study group held at the Ciba Foundation under the auspices of the institute for Research into Mental Retardation. The study group was made up of 28 participants (listed on page 303) representing about equal numbers of research workers (mostly with applied interests) and professionals in the education and hospital services. It was under the chairmanship of Professor Mittler, who edits the volume under review.

Compilations such as this which include papers, bibliographies, semi-formal critiques, and contributions in open discussion, often provide rather unsatisfactory and uneasy reading material, but in this case, partly because of the quality of the discussants, this is by no means so. The main papers have been written or rewritten in such a way as to make them in style and approach suitable for the printed page and the individuality of the different points of view in the open discussions is so well preserved that they have an almost dramatic quality. What will X's contribution be on this question, one asks. Will he be so sure of himself this time? Will Y be as moderate and sensible as before? Will Z's academic phraseology clarify or obscure the issue? In fact, each generally runs true to form, and the form is very good.

The topics are grouped under five heads—assessment strategies, content of assessment, planning treatment programmes for children, and the same for adults, with, finally, consideration of recent and future developments. The emphasis is very much on what is new and experimental in assessment and treatment procedures.

To select for special mention any of the 12 papers is invidious and must depend on personal interests to some extent. All are excellent in their particular way and are the fruit of exceptional individual expertise in different fields. Some angles tend to reappear in different contexts, other lines of thought are more specific.

The whole is opened and the general tone set by Professor Mittler's talk on the 'Purposes and Principles of Assessment.' The emphasis is strongly on positive evaluations in actual learning situations rather than on tests in the traditional sense. A.D.B. and Anne Clarke's paper supports this point of view and shows the poor predictive value of test results. The particular problems of language and personality assessment of subnormals are raised by Joanna Ryan and J. Hogg in two papers of great interest, the latter offering also a very full and useful bibliography.

The sections on treatment programmes are more strictly practical in viewpoint. Joan Reynell discusses pre-school training and A. T. Ravenette in a first-rate contribution on school-age subnormals gives some apt and refreshing illustrations. A particularly interesting one (among several positive and negative examples) shows the teacher missing an opportunity through failing to accept the child's spontaneous activity. It is worth quoting :

> Janet (9) is playing with beads in a free activity period before lunch. An observer is watching but is not directly involved.
>
> *Janet* : This green one goes there. Where's another green ? One, two, three, six (counting). One underneath (having found one under a chair). (To observer) : Do you want one ? Here is two. (Gives them to observer.) (Hides one under a boy's sleeve) : Feel it (laughs). You feel again. You feel it.
>
> While this is going on, the teacher appears.
>
> *Teacher* : Janet, you can do this properly (referring to putting beads on to an abacus). It's not for playing with your fingers.

In the next paper, E. Whelan, dealing with the treatment of the adult, provides useful facts, valuable tables, and an extended up-to-date bibliography.

The section on recent and future development stresses the use of behaviour modification (W. A. Bricker and Diane Bricker), ethological techniques (K. Connolly) automated assessment (N. Beasley), and functional analysis (C. C. Kiernan) in the assessment situation. A final general discussion returns to some of the questions which have been exercising the study group during their deliberations such as what are the essential skills for which the subnormal should be trained, what is the appropriate role of parents in their training, and how are knowledge and suggestions to be disseminated ?

A book like this, excellent as it is, is only a part answer to the last question. It should certainly be read by all students, workers and research people. It is to be hoped that it will be reprinted as a paperback, since at £5·50 it is beyond many pockets.

O. C. SAMPSON.

NASH, R. (1973). *Classrooms Observed. The Teacher's Perception and the Pupil's Performance*, London : Routledge and Kegan Paul, pp. 138, £2·50.

This is an unusual book. The reader is clearly told of the author's dissatisfaction with conventional empiricist models and methodologies and Dr. Nash promises a radically different theoretical posture in symbolic interactionism. He will also employ novel investigative methods including that of direct observation in the classroom. No useful purpose would be served by contesting here the novelty of these endeavours since the themes of the book are important though perhaps not novel. Difficulties may arise for some readers in accepting the high degrees of inference made by the researcher in this report : for example, " The teacher knows full well that Jamie was talking." But it is precisely such statements, of course, which underline Dr. Nash's quarrel with empiricist tradition. They appear throughout the book, for example, " My assessment of Alec's situation suggests that he knows that he is bright, knows that his teachers know he is bright and knows also that they know that he knows they know he is bright." Such statements do tend to raise that host of profound questions about verifiability which now bedevil us. Dr. Nash's work itself exposes the limitations of conventional questions about validity and reliability, but if such questions seem now to be outmoded and unsuitable, the reader's predicament is great, unless we are reassured by the author's being " prepared to argue that the observations were a good and typical sample."

Two departures from old-style convention are notable. The first is a methodological one : the author states that verbatim notes were made by him of classroom interactions and that these notes were later coded against a modified Flanders schedule. This procedure must be accounted unusual since there are notorious difficulties in deriving reliable Flanders records even from high-speed shorthand accounts of interactions in primary classrooms. The second example of unusual procedure is more disturbing because it is more pervasive. It consists in the judgments made by the researcher of the teachers whose classroom behaviour he was allowed to observe. One has a taste of this early in the book when one teacher is described as adopting a group teaching method which " could scarcely have been bettered," and another's action is described as " so crass it may seem beyond belief." A number of outspoken criticisms are made of the teachers' failures to meet the standards of teaching claimed (I think disputably) to be those of the Scottish Education Department. In his concluding chapter one reads the author's final comments on the teachers who had helped him to research. Some teachers he has found congenial and acceptable ; of others he writes, " I have met a few whom I would recommend for urgent re-training in a profession where they do not come into contact with children." However, such statements, along with other instances of the autobiographical, are perhaps to be accepted in the new wave.

One's worries about verifiability and procedural convention should not detract from the interest and importance of the themes explored in this book. Questions are raised about the relevance of social class as a predictive variable in the area primary classroom. The dynamics of teachers' perceptions, pupils' self-concepts and pupils' friendship choices are explored and these are considered in relation to the messages conveyed by the regimes adopted in the schools and within the separate classrooms. These are the fascinating complexities of the classroom world and in themselves are important matters. I am not sure, however, that I have thoroughly enjoyed the manner of much of Dr. Nash's writing.

M. CAMERON-JONES.

OGILVIE, E. (1973). *Gifted Children in Primary Schools.* (Schools Council Research Studies). London : Macmillan, pp. 279, £5·00.

" But the teacher confessed that she was also one of the most difficult children to teach as with the child's unquenchable thirst for knowledge, given the chance she would stop any lesson with endless questions and would only concentrate and listen when it suited her."

The above extract from one of the case studies in this report highlights the main concern of the enquiry—problems associated with teaching gifted children of primary school age. The study, which lasted a year, was conducted on behalf of the Schools Council, and during this relatively short time a great deal of significant and needed evidence was obtained in an area of study about which there is a dearth of knowledge.

Chief Education Officers were requested to provide information about local facilities, to nominate schools providing outstanding opportunities for gifted children and to establish a study group of interested teachers. Thirty schools were visited by Ogilvie, who interviewed staff, asked them to complete a questionnaire, write a report and provide case studies of pupils. Eighteen study groups were formed, each was asked to submit a report and members also completed the questionnaire. The analysis of the latter was based on 370 replies, which included those from 30 students. Ogilvie acknowledges that the group of teachers is a biased one " . . . in that it has a stated interest in giftedness." He stresses the need for caution in interpreting the results: the project was " . . . exploratory and suggestions made must be regarded as more or less tentative."

The principal argument advanced in the report is the need to maximise provision of individualised methods of teaching and learning because they are critical factors in the development of potential. A curriculum offering a diverse range of activities would enhance the likelihood of ability being expressed and recognised. One of the study groups commented that the recognition of gifted children is the " biggest gamble in the whole educational system . . . (it is) so dependent on luck."

The groups welcomed the idea of encouraging real concentration, not just an interest, on a particular gift. 92 per cent. of their members considered that : " Lack of opportunities to exercise specific talents is an important condition possibly harmful to the development of giftedness." Four-fifths of the teachers maintained that low expectations had an adverse effect on performance, group activities tended to produce ' normal ' situations and ' normal ' results ; much more could be demanded of the very able child.

Teachers were asked which methods and conditions would be especially conducive to the development of giftedness. Periodic specialised teaching within a school and the employment of more peripatetic specialist teachers were highly favoured. There was massive agreement over the value of enrichment, though only 4½ per cent of local education authorities made such provision in school hours. A quarter supported Saturday morning classes, usually in the form of music ; there were no mathematics, science or language classes.

The report is a demanding one to read, the findings could have been presented with greater clarity, for instance, some histograms would have been of help. It merits careful study " . . . the very great majority of teachers felt that gifted children present a certain class of problems which are worthy of study in their own right."

J. Wilks.

Schools Council Research Studies (1973). *Evaluation in Curriculum Development: Twelve Case Studies.* Basingstoke: Macmillan, pp. 197, £1·85.

With the profusion of new curricular approaches, materials and methods which stemmed from Schools Council development projects in the 1960s and early 1970s, there was a need for a continuous process of modification and refinement. In this, the role of the evaluators was crucial, for it was their task to ensure that curricular changes were worthwhile and workable, and that the philosophy behind them was kept under constant review. Moreover, as the curriculum changed, their reports were invaluable in informing those concerned in the schools of just what was involved, and in assisting programmes of dissemination and in-service training which followed.

This volume sets out to clarify the position of evaluation in Schools Council projects, and the 12 case studies cover a wide range of approaches and methods. Each has been written by the evaluator concerned and clearly illustrates quite independent approaches to basic problems and the employment of a great variety of techniques.

Introductory chapters examine the role of the evaluator and attempt to relate the different accounts by emphasis on three aspects of evaluation—the level of thought, the range and the degree of rigour. The accounts themselves are full of revealing insights into problems faced by individual evaluators and their concept of their own particular role. One values independence, emphasising that evaluation of material should be in the hands of someone who is not emotionally or intellectually committed to it; another sees the evaluator's task as setting up a counter-image to that set up by the project; yet another stressed the need for limiting individual commitment.

With regard to the techniques employed, these are as varied as the projects themselves. In each case there has been a fundamental need to clarify objectives and philosophy before the collection of information so essential to refinement or change. Throughout there is an inescapable impression of comprehensive and searching evaluation which has been both formative and summative. Furthermore, the contributors have been conscious of the fact that, as one puts it, " all evaluation is concerned with providing information for decision-makers."

This book is more than its title infers—it is a basic book for all concerned with teaching and learning at every level of education, for the importance of effective evaluation cannot be over-emphasised. Lack of it in the past led to a curriculum sorely in need of the revision and up-dating for which the Schools Council may justly claim some credit. It is a process all will wish to see continued with the enthusiasm and rigour so apparent in this volume.

R. H. RICHARDSON.

SMART, R. C., and M. S. SMART (1972). *Readings in Child Development and Relationships*. New York: Macmillan, pp. xviii+535, £2·90.

The preface draws attention to the fact that the readings represent a sampling of the field of child development and relationships in respect of difficulty level. Some are written in non-technical language for the intelligent public, others are research reviews from professional journals. The selections differ, too, in the particular discipline concerned. Thus there are articles written by psychologists, anthropologists, educationists, medical specialists, psychoanalysts, psychiatrists and pediatricians. This concern for the contributions of workers in allied fields, all interested in the development of the child, stems from the fact that the Smarts began their professional lives in the special environment of the Merrill-Palmer school, where the teaching of child development was rarely carried out by one teacher to one class. Three or four might be present, each with a particular point of view and contribution to make.

Selection having been made on level of difficulty and range of discipline contributing, the content was further organised on an age-level basis " in order to treat the child as a whole." It is divided into four main stages (and ages): infancy, the pre-school child, the school-age child and the adolescent. Part five consists of a summary entitled an overview of human life and growth. Within these stages some core topics are treated, as well as those peculiar to the stage itself. Thus, infancy contains articles on prenatal development and birth, as might be expected; part three on the school child includes problems of backwardness as well as competence as a school learner. There are common areas, however. Intellectual development appears in the pre-school and school child as well as in the adolescent. Relationships with people occurs in every part. But these contributions remain selected readings, often dealing with quite different aspects of the general topic and naturally cannot be regarded as forming a continuous sequential development of the subject. It is not intended that they should, for the readings are to be regarded as supplementary to the editors' book *Children: Development and Relationships*, though they can indeed be used with any text in child development.

It is difficult to form an impression of the intended readership. Students of child development are drawn from many sources and pursue the study with varying objectives in mind. That some beginners will study it is clear from the advice given on different kinds of reading and note-taking included between preface and main text. However, the selections though often short deal with points of interest, whether these be general principles or research carried out in the field. Unlike many books of readings, the research presented covers a wide period of publication, with many up-to-date investigations. The references vary in number according to the article. None are so few nor so numerous as to be discouraging to the reader. One of the weakest aspects of the book is the paragraph which usually precedes each selection, which sets out the main issues in the ensuing extract. But this can well be overlooked. Taking it all in all this book is worth reading by those who do not have an exhaustive knowledge of what has been happening in research in many areas of child development, and who would appreciate a swift bird's eye view of some important aspects which the references will enable them to follow up.

GERTRUDE KEIR.

SOCIETY FOR RESEARCH INTO HIGHER EDUCATION (1973). *Motivation—Non-cognitive Aspects of Student Performance: Papers presented at the Eighth Annual Conference*, 1972. London: SRHE, pp. 118, £1·80.

The appearance of this volume is timely, coming in the same year as two substantial reports on the prediction of university success from ' cognitive ' data (one by the Scottish Council for Research in Education and one by the NFER) and following on important articles in this *Journal* on personality and academic achievement.

Not surprisingly, the concept of motivation comes under fire. " Motivation is an unpopular word with our conference contributors." admits the Preface. " Has it any precise meaning ?" asks the president of SRHE, Mr. Charles Carter. Alan Smithers calls it a " notoriously elusive concept." " It is a word that we could usefully do without," says Michael Parlett—" a dustbin concept " in fact. Jones, Mackintosh and McPherson call it " a conceptual charlady—put there in attempt to mop up *all* of the variation in achievement that cannot be explained by cognitive factors."

Nevertheless, we are left in no doubt as to the importance of whatever it is the troublesome word connotes. Alan Smithers (' Factors in the success and failure of student ') finds that motivational variables, though at first appearing to add little to academic data in predicting success, come into their own in interaction studies. He traces various ' paths to success ' (one of them, interestingly, being that of a divergent thinker to success in science). Charles L. Jones, H. M. Mackintosh and Andrew McPherson (' Questions of uncertainty: non-cognitive prediction of first year achievement at university ') are more sanguine than most about prediction. They find that school achievement has relatively good predictive power (correlations around ·5, whereas most investigators get them around ·25), but non-cognitive factors can add considerably to it. Specially interesting are correlations between certain questionnaire responses and success when school achievement has been partialled out. For instance, ' having a job in mind ' correlates positively with first-year performance in law but negatively in engineering ! Having ' no particular motive for entering university ' correlates positively with first year performance in sociology but negatively in psychology Sidney Crown, C. J. Lucas and S. Supranium (' Classification and measurement of study difficulties; psychoneurotic and motivational aspects of study difficulties ') concentrate on the pathology of student-study difficulties rather than academic success. They claim that the University College, London Study Difficulty Questionnaire is a good research instrument, revealing both 'neurotic' and 'work-related' factors in study difficulty. In the discussion after this paper more research into these 'work-related' factors, especially that named 'work-satisfaction,' was rightly called for. Michael Parlett's paper ('Conditions and contexts for academic motivation') emphasises what he has elsewhere called the anthropological approach in educational research. We must never forget, when observing the performance of students, that a university course is 'only part of their world.' We must first understand the whole milieu : we shall then find that the distinction between cognitive and affective factors becomes meaningless.

J. A. Wankowski ('Disenchanted elite') attributes much student failure to the 'disenchantment' syndrome arising from "a sudden discontinuity of learning competence on entering the university." The transition from an over-protective sixth form to 'a research establishment with students' is too much for some. After reporting attempts (using the familiar extraversion/neuroticism axes) to discover that kind of person is prone to such disenchantment, Wankowski recommends "narrowing the chasm of differences in tuition" between school and university. What he asks the university to do seems reasonable, but what he asks the school to do looks suspiciously like the deliberate importation of some well-known defects of university teaching into the school in the hope that they won't hurt so much when the student goes to university

Professor Elton ('Motivation and self-study') argues, briefly but convincingly, that one way to motivate students is to let them participate in the planning of their own courses.

All in all, this is a helpful collection of papers, a common bond among contributors being awareness of the limitations of this kind of research. Jones, Mackintosh and McPherson come uncomfortably near the truth when they say that researchers might give university students a rest for a while and get to work on university teachers instead !

STANLEY NISBET.

STEPHENS, J. M., and EVANS, E. D. (1973). *Development and Classroom Learning*. New York : Holt, Rinehart and Winston, pp. xi+692, n.p.

Sub-titled predictably 'An Introduction to Educational Psychology,' this is another book whose aim is to combine comprehensive coverage of traditional material (already, one supposes, the staple course content in most teachers' colleges, colleges of education and university education departments on either side of the Atlantic), with the updating of terminological and experimental information. A pair of American authors collaborating on a book of this size can usually be depended upon to succeed at least moderately well in both objectives. The periodic appearance of such volumes is a service for which most conscientious instructors probably feel grateful. Students can collect under guidance a working minimum of dependable information, their teachers can top up their own existing stocks.

Such productions have the disadvantages of their merits, of course. We have become accustomed (resigned ?) to unexceptionable reference systems ; but we may still suspect that exhaustiveness, or the appearance of it, is off-putting to the most practised reader, let alone to students at the information level to which the title is presumably addressed. Do any of them in practice ever pursue even as far as the end-of-chapter lists, the parenthesised name and study credits that interrupt the text ? The present writers do avoid the worst of this side effect, partly by adopting the prudent arrangement, familiar from other American books, by which details of illustrative studies are enclosed in coloured panels and consequently are 'skippable.' But credit is due also to the presentation. Understanding is as much an objective of theirs as information and the writing-style is modest and non-pedantic, which should make it effective with students.

Probably in a general text choice of emphasis and order of topics should be an author's privilege, and the plan of this particular book justifies the title. Development is specifically dealt with only in the first part which is much the shortest and introductory to the main topic. This is the statement of the psychological principles of cognition and instruction and their explanation in concrete terms of classroom practice. It seems to me to be well achieved. Correspondingly in part three, the various theories of personality are applied to the process of socialisation.

Part one, with only two chapters on development, is necessarily eclectic. It recognises the modern idiom by giving language acquisition a large share. In explaining the Piaget system, nowadays practically a required exercise in this context, it succeeds in being both authentic and attractively applied. No mean task, as everyone knows who has had to try it on an audience.

Part two would not, as experienced readers of reviews must realise, be fairly represented by a list of topics. None of the standard ones like reinforcement procedures, teaching for transfer, creative problem solving and classroom management (to take a mixed handful) is under-represented either on the traditional or innovatory side. Perhaps the chapter on structure and meaning with its clear account of Gagné and Ausubel, deserves special mention. Conversely, British educationists, some of them anyway, might find themselves in less than perfect sympathy with all the views in the chapter on assessment.

The subject matter of part three is naturally more likely to create such dissatisfactions, and differences in the social context make the conclusions appear less valuable for British teachers and British students. The study of adolescence, in fact an excellent one, is particularly affected since, of course, it follows the fashion for the sociological rather than the psychological account. The coverage of the drug scene, for example, has a magazine article air in spite of, or perhaps because of, its well-meaningness and moderation. Similarly, the chapters which begin and end the book, one on the cultural position of teachers and the other on their stresses and (hopefully) adjustments, do contain ideas from people like Rogers and Lazarus which are familiar to psychologists everywhere ; but for British readers they do not enclose it quite so comfortably as its authors intend they should.

MARGARET MUNRO.

TAYLOR, W. (1973). *Research Perspectives in Education.* London : Routledge and Kegan Paul, pp. 238, £3·25.

This book, like educational research itself, has multiple functions and operates at several levels. It is perhaps best viewed as an essay in the sociology of educational knowledge. Taylor, in his chapter ' Knowledge and Research,' utilises Wirth's approach. He takes four elements in the task of understanding a system of knowledge and looks at each of these elements as they apply to our current situation. We could equally take these four elements and apply them to this volume on educational research.

The styles and methods of thought used in the variety of disciplines that contribute to educational research are represented here. Whether there is a reworking of these data of intellectual history is more questionable. Some of the authors seem to be more concerned with polemics than with a reanalysis of the possible contribution of their discipline to our understanding of education. In some cases, there is more concern with ' old, unhappy, far-off things and battles long ago ' (long ago if a decade in educational research is the equivalent of a year in politics) than with more contemporary issues. Taylor himself comments on the current shift in the sociology of education to an emphasis on " action perspectives stressing the importance of interactive factors of meaning and of sociological processes." These developments are not, however, explored in the relevant disciplinary chapters.

Wirth's second element requires the exploration of the way in which the purposes of particular social groups find expression in particular theories and doctrines. A common commitment of the authors in this volume is to "sustained, systematic enquiry designed to provide us with new knowledge." This is the doctrine; what are the purposes and interests which lie behind it? In some ways, it is obvious. All of the authors have university appointments and depend for their intellectual satisfaction, if not for their livelihood, on research. With a growing disillusion with the value of education and growing scepticism about the value of educational research for educational policy makers, we shall have to find a very convincing argument for the value not perhaps of sustained systematic enquiry but of conventional educational research based on the traditional disciplines.

Wirth's third element which Taylor takes up is the extent of resources made available for developing particular fields of study. If, in Britain, we are to maintain the share of resources for educational research that now exists, we shall need strong evidence and convincing arguments. Nisbet asserts that "we do not need to show that psychology can contribute to educational research today." Perhaps not, but we certainly need to show that conventional educational research can contribute to improved educational practice.

The fourth element of Wirth's that Taylor cites is a need for an analysis of the institutional organisation which provides the framework for educational research. Taylor himself does this very lucidly in the first chapter and Harnquist follows it with a discussion of training and career structures of educational researchers based largely on the American literature and Swedish practice. One wonders quite how the characteristics of successful American educational researchers listed on page 59 would apply in Britain. Yet the policy of the ERB, as described by Taylor, seems to be based on a too easy assumption that it does.

This is an informed and authoritative book by the most influential figures in educational research, the director of the University of London Institute of Education, the chairman of the Educational Research Board of the SSRC, professors of education at Lancaster, Bristol, Manchester, Aberdeen, Leicester, London and the Open University. It is a roll call of the establishment, Taylor, Peters, Nisbet, Entwistle, Simon, Musgrove, Swift and Hoyle. Undoubtedly, it tells us where we stood at the beginning of the 1970s. I am not sure, however, that it tells us which way we were facing.

W. B. DOCKRELL.

TURNER, B. (Ed.) (1973). *Discipline in Schools.* London: Ward Lock Educational, pp. 122, paper £1, cloth £2·50.

With the present increasing incidence of juvenile delinquency, the controversial problem of discipline has inevitably become a major cause for concern. The publication of a book like *Discipline in Schools*, edited by Barry Turner, is therefore particularly relevant and topical. This relatively inexpensive paperback, with a modern, glossy, eye-catching cover, contains a collection of 12 articles contributed by various academics and teachers. The papers, two of which are journal reprints, represent a variety of views on discipline, and the form it should take in the home and school in order to prepare children best for adult life.

The editor's brief introduction emphasises that the book's aim is not to promote one particular notion of 'proper' discipline, but to let the reader draw his own conclusions. Such impartiality is difficult to achieve, but the scope of the articles is wide, with only the firm authoritarian traditionalist viewpoint under-represented.

Corporal punishment is scarcely mentioned at all, but this is probably because traditional methods of discipline have proved themselves mainly inadequate in today's society with its changing values and standards. The problem presented by the book is, therefore, which new methods to adopt. Among the alternatives suggested are the notions that society itself must become involved with discipline, and change its standards, while parents must support the schools more, whether over stricter rule or a freer curriculum. Most important, the teachers must look inwards and by knowing themselves better, develop a real love and respect for their pupils. Schools, teachers and pupils must all change towards a greater involvement with one another—" The discipline of any school " must be " an ongoing experiment in personal relations " (p. 120).

The essential appeal of this book is that it refuses to wear any idealistic blinkers about children's behaviour. The authors here obviously have no illusions, and have first-hand experience of the difficulties of teaching in large, overcrowded, understaffed schools with poor facilities. They describe graphically the attendant problems of discipline, due to factors like meaningless curricula, no feeling of identification with the school, and the gap between the cultures of the teacher and pupil.

Several papers offer very practical advice to the beleaguered teacher. Keith Wadd's ' Classroom power ' is an excellent exposition of the ways of keeping order in a class, and the likelihood of their success—it should be part of every student teacher's training. Another noteworthy article is Derek Wright's ' The punishment of children,' which is a review of the latest experimental studies on punishment, including those of Aronfreed, and draws attention to the short-term value of punishment as an aid in the development of self control.

Overall the book is concise, clear and well-written, with little repetition. The tone varies from scientific review and case study to the dialectic of R. F. Mackenzie's ' Teachers of the world unite.' The balance of approaches between practicality and theory is finely kept, and the articles read well in sequence, although the choice of an opening article ' Family view,' while excellent in itself, is unusual as a start to a book specifically on school discipline. Despite the limitations set by its brevity, there are surprisingly few aspects of discipline left untouched, if not actually explored in depth, by this paperback. By virtue of its fine blend of advice on face-to-face contact with children, and thought-provoking articles on teacher/pupil attitudes and society's responsibilities in general, it has won a deserving place on the bookshelves of teachers and parents alike.

J. McQuoid.

Tustin, F. (1972). *Autism and Childhood Psychosis.* London: Hogarth Press, pp. 200, £2·50.

Based on her work as a psychotherapist, the hypothesis suggested by Dr. Tustin is that clinical autistic behaviour is different from the normal behaviour shown by the very young baby (which she calls normal primary autism) only in degree; pathological autistic behaviour can be demonstrated when this early developmental situation is seriously hampered by a failure in communication between mother and baby arising from either poor nurturing or physiological defects or both. Although the contribution of defects is acknowledged, and to some extent discussed, the main emphasis is on nurture which is defined at the primary stage on the mother's ability to take her baby through the critical period of differentiation between ' *me* ' and ' *not me* ' without undue harm. To the breakdown and petrification of this developmental stage is assigned the main aetiology of pathological autism.

Following from this Dr. Tustin develops a scheme of classification derived from the behaviour and psycho-dynamics of her patients which attempts to include children who do not come readily into the classical categories of early infantile autism and childhood schizophrenia. Although the nomenclature, particularly the use of capital letters, is rather off key, the concepts presented are thought-provoking even to someone not psychoanalytically orientated. The classical syndromes are discussed, differentiated and integrated into a subtle and embracing silence which includes three pathological categories each with several subdivisions; The heartening aspect of this classification is that in defining her concepts Dr. Tustin gives clear guide lines for treatment and, indeed, seems to provide a framework for less experienced psychotherapists.

For the general reader this book is, perhaps, most notable for its magical understanding of the children's experiences. For example, her descriptions of John: " bodily experienced black despair " widens our understanding of the terror and frustrated rage felt by autistic children and should make us ponder a little before we attempt to manipulate their behaviour to make it more ' socially acceptable:' It would have been good to have had more about Dr. Tustin's work with the children, not only because published accounts of therapeutic sessions are rare but also because they can sharpen our perceptions and deepen our compassion.

E. Clayton.

Wedell, K. (1973). *Learning and Perceptuo-Motor Disabilities in Children.* Chichester : Wiley, pp. 345, £8.

Learning and Perceptuo-motor Disabilities in Children does not assume any prior knowledge of the subject on the part of the reader. It is essentially a critical review of the evidence to date with suggestions as to how research in the field might best progress. This book is concerned with the organisation of sensory and motor functions in children as distinct from the efficiency of receptor and effector systems, and it starts by looking at the development of sensory functions and motor functions in normal children, from birth to maturity, before moving on to consider children with specific deficits in these areas. These chapters contain a thorough and well-organised survey of the experimental literature and the findings are critically evaluated and integrated. At this stage the interdependence of sensory and motor organisation and the methods and success with which a child may use an ability in one area to compensate for a disability in another area, are considered at some length—the compensating effects of other factors, cognitive and environmental, are also considered.

The effectiveness of various training schemes directed at modifying sensory and /or motor disabilities are evaluated : the conclusion reached is that although these schemes may well produce improvement in the specific sensory or motor function being tackled, there is little evidence to indicate any corresponding improvement in educational attainments, indeed, improvements in educational tasks appear to be best effected by a direct attack on the tasks concerned.

Throughout this book the emphasis is very much on the analysis of the nature of the sensory and /or motor disabilities as these affect the individual child, rather than on the classification of disabilities. This is a most refreshing approach following the bulk of research in child development which has concerned itself primarily with establishing norms of performances achieved by children at successive ages rather than with how such performances have been achieved.

H. E. Nelson.

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